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CONTENTS OF PREVIOUS NUMBER

MARCH, 1928. NUMBER 3

Simple Subcortical Mastoidectomy. Julius Lempert, M.D., New York.

Nonopaque Foreign Bodies in the Esophagus and Esophagotracheal Fistula: Their Demonstration by Ingested Iodized Oil. Samuel Iglauer, M.D., Cincinnati.

Standardizing the Tuning Fork. Douglas Macfarlan, M.D., Philadelphia.

Peritonsillar Infection. Samuel D. Greenfield, M.D., Brooklyn.

Clinical Notes:

The Nasal Ganglion and Chorea: Case of a Patient Permanently Relieved by the Injection of Alcohol. Hiram Byrd, M.D., Tampa, Fla.

Instruments for Injections of Iodized Oil into the Sinuses: New Adaptations for Opaque Injection into the Accessory Sinuses of the Nose and Ear. Robert H. Fraser, M.B. (Tor.), Battle Creek, Mich.

Progress in Otolaryngology: A Summary of the Bibliographic Material Available in the Field of Otolaryngology. Peroral Endoscopy. Louis H. Clerf, M.D., Philadelphia.

Abstracts from Current Literature.

Society Transactions:

Section on Ophthalmology and Oto-Laryngology of the Medical Society of the District of Columbia.

Section on Otology and Laryngology of the College of Physicians of Philadelphia.

Book Reviews.

Directory of Ophthalmological and Otolaryngological Societies.

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RECONSTRUCTIVE SURGERY*

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NEW YORK

In this paper, I have endeavored to present a rounded picture of reconstructive surgery as it is seen in the clinic from day to day, with special reference to certain features.

The recent developments may be said to include: (1) a different attitude toward the importance of the preoperative period; (2) a simplification of the more familiar procedures in the interest of the patient, with a view to shortening the stay in the hospital; (3) the devising of new methods of replacement and new uses for certain tissues; (4) some new factors in the problems of postoperative care; (5) the confidence with which the principles of reparative surgery can be carried into use in certain fields of major surgical intervention, and (6) the ever increasing concern for the restoration of function as the end-result of all reconstructive procedures. I shall endeavor to illustrate the significance of the newer developments under each of these heads.

PREOPERATIVE PREPARATION

Experience has taught that the problems of after-care can be greatly simplified if one gives proper concern to the state of the patient and to the state of the tissues by which the repair is to be effected, before the operative stage is reached. If, when the reorganization begins, the skin is in such a position as to be intractable, little can be done about it. But much can be done before the procedure begins.

THE SKIN

The skin is a more complex organization than might at first be supposed. One has to know it intimately and microscopically, and must treat it with the respect it demands; otherwise, it sensitively refuses to produce the desired results.

It confronted my associates and me with an eternal why? It compelled us to remember that the red coloration of the skin of the face, caused by the presence of blood in the capillaries, is not present to the same extent in skin brought from unexposed parts.

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*Address delivered before the Academy of Medicine of New Jersey, Dec. 21, 1927.

Relatively thick skin brought from other parts can not be used to replace the skin of the upper lid. An epidermic graft cut so thick as to include part of the corium may produce hair and rancid exudations where they are unwelcome. A free graft that will live under a pressure of 30 mm. of mercury may die if the pressure is much more or less. And yet an eyelid skin graft may be more successful under a pressure of 20 millimeters.

A good blood supply is an essential to a pedicle graft; yet if the arterial pressure is too strong, venous stasis and death at the edges of the graft may occur.

If infinite patience is used in suturing, the skin can be induced to heal and leave an almost invisible scar. At almost every approach, the skin will respond to considerate treatment and will rebel if that treatment is denied.

Preparation of the Skin.—There is seldom anything imperative about an operation for surgical reconstruction. If the hospital tests reveal the presence of unsuspected syphilis, cardiorenal disease and pernicious anemia, the operation is postponed or it may be canceled.

If the decision is made to proceed, then the interest of the staff and the patient must be enlisted to bring the skin, which is usually a factor of the first importance, to a satisfactory state. Since there is no need for haste, repeated cleansing with soap and water is imperative. Stimulation with alcohol, carbon tetrachloride, etc., follows. It may even be desirable to take a good deal of time to get the beneficial effects of light treatments in order to bring the skin into the condition desired.

Finally, it should be remembered that the skin itself may harbor some of the agents that are productive of infection later. One cannot place reliance on a final washing with iodine to get rid of the organisms that may be on the skin or beneath its surface. Many of the organisms persist after its use. The mercury compounds and acriflavine are more successful in eliminating these. If the organisms persist, they will cause infection later, and the blame is likely to be placed on the carelessness of the surgeon and attendants, rather than on the skin itself, which is at fault. The most nearly perfect antisepsis is the best guarantee of postoperative success.

INJURY BY INSTRUMENTS

When one knows how infinite are to be the precautions taken in the stage of suturing, it is evident that the contact lines of the skin should be spared the injury that might result from a knife, the cutting edge of which is deficient. Examination of the blades under low power magnification will sometimes reveal notchings that cannot fail to produce jagged edges on the line of incision into the skin.

For a similar reason, metal forceps are not to be used for the handling of grafts. They exert a destructive pressure on the living cells. Epidermic grafts are best lifted by the fingers and full thickness grafts by the suture threads inserted at the ends while the graft is being raised.

Injury by chemicals must also be avoided. Saline and Ringer's solutions are actually injurious instead of being useful when a graft is steeped in one of them. They tend to deplete the cells of the sustaining plasma by which they are surrounded. The grafts are best left in the serums produced when they are cut.

The epidermis, which is without vessels, is sustained only by lymph, and the fibrins formed by its serums fix the epidermic graft to its new base. Such fibrins also, in the case of the full thickness graft, bind it to the base for the first full day after implant. Obviously, in neither instance is there any good purpose in filtering the serum away.

POSTOPERATIVE PROCEDURES

Anesthesia.—Almost all these reconstructive procedures can be conducted under local anesthesia, a distinct advantage to both patient and surgeon.

It is surprising in how many instances local anesthesia is found to be distinctly preferable to the general anesthesia the use of which is commonly accepted as a routine measure.

Bandaging.—When the object is the restoration of symmetry to the face, a factor that is inseparable from correction of disfigurements, it is desirable to have a view of the whole face throughout the operation. Bandaging before operation is therefore restricted to the imposition of gauze, which is steeped in a solution of mastick dissolved in benzene and other ingredients, made adherent to the sides of the face and carried up over the forehead at the border of the scalp.

Refinements of Postoperative Care.—Notwithstanding all that may have been done before operation and despite the fact that the utmost has been attained in cleanliness, watchfulness, attention and prompt resort to prescribed treatments, the tissues are still likely to make trouble as there are variations in vitality and in resistance to infection in different patients. All that was done to improve the state of the skin may have to be supplemented at this stage by recourse to sunlight, artificial sunlight and other variations of light therapy.

Again, skin grafts are susceptible to cold; the transplantation will fail if they are not kept warm. With pedicle grafts, I make it a routine procedure to use massage at short intervals for the first twenty-four hours. In this procedure, a solution of magnesium sulphate of the same temperature as the blood is used, and if stasis develops warm compresses of the same solution are applied promptly.

Bandages applied after operation are dispensed with as soon as possible. They are looked to for little more than to sustain the tissues in their new relations until the parts have set. After that, I revert to the procedure of leaving the wound open. Air and light are not conducive to infection while bandages are. In these cases, the first concern is to prevent infection and the second is to control it immediately.

This applies to the sutures as well; infection may be carried into the wound by the threads. As a first precaution, the threads are passed from within outward when that can be done; as a second precaution the sutures are removed in two days. It is a rule that a suture is not inserted unless it can be removed in three days at the most. Suture points are watched for the slightest indication of infection, and when such appear they are dealt with at once.

In hospitals, the open wound may be conducive to contagion. Diphtheria has been known to develop on a pedicle flap. Partly to meet this danger, the patient is kept in a screened bed, which can be easily rigged. Patients like this semi-isolation, and will cooperate in the first postoperative period so that they may have the screens sooner. The promise of the screen as a reward for maintaining immobility on a bed without pillows almost always produces the desired result.

SIMPLIFICATION

Since the cooperation of the patient is requested, it is only fair to simplify as much as possible the procedures to which he submits, and to reduce to the minimum the duration of his stay in the hospital.

As an example of success in both endeavors, attention is directed to certain procedures evolved for the correction of nasal disfigurements. At first the tendency was to resort to replacement by transplanting cartilage from other parts of the body. But since it was so often the case that in the correction of the disfigurement it was necessary to reduce a hypertrophied alar cartilage, one realized that here was a supply of the material required, provided the replacement did not demand too large an amount of cartilage. It was also realized that when the nasal bones had been flattened, it was practicable to restore the natural arch by releasing the bones at their junction with the maxillae and, by pressure with the thumbs, to restore them to the original position. After this has been done and the nasal cartilages have been readjusted, as a rule, only a small depression remains over the cartilaginous bridge; the morsels taken from the alar cartilages prove sufficient to remedy this defect. Thus one is saved from the necessity of such a serious operative procedure as is involved in obtaining cartilages from the costal crest. The patient is also saved from the long hospitalization which follows that

procedure, and can leave the hospital in from three to four days, instead of in from ten days to two weeks, as formerly.

It may be mentioned that this early departure is influenced further by the care that is exercised in respecting the circulation when the tissues are separated to admit the readjustments. The skin is separated over a wide area, as a preliminary, and the deeper separation is conducted with great care. The result is that after the operation there is an almost total absence of ecchymosis, and the small amount present yields rapidly to treatment.

Just as the disfigurements caused by injury are of infinite variety, so are the expedients that must be resorted to in readjusting the insulted tissues. Almost invariably there is a displacement of the tip of the nose, the realignment of which demands the utmost delicacy and ingenuity. One may find hypertrophy at one or both lateral cartilages; separation at the mesial folds, with resulting cleft; dislocation of the septum from the spine of the maxillae, inducing distortion and retraction of the columella, and often distortion of the septum itself, with blockage of the airways. It is interesting to note that several of these conditions may follow operation for resection of the septum, either because the buttress left after operation is of insufficient strength or because it has been weakened at its junctures with the bones by subsequent inflammation or abscess.

Correction may call for some excision from the septum when overlength at the tip has been produced, or it may be necessary to enmesh a triangular section of the septum in the columella if the nose has been shortened. In some conditions the tip may be restored to the normal relation by reestablishing the buttress and then, by use of the orthopedic stitch, effecting a stable relation between the septum and the columella. If the suture in the septum is placed above that in the columella, the columella is lifted when the ends are tied, thus eventually raising the tip. Conversely, if the suture in the septum is placed below that in the columella, the tip is drawn down, if that is the object in the particular case.

It may be well to remark here that in dealing with nasal disfigurement, one is not called on to produce a nose that is classically perfect. Disfigurement consists in the fact that the organ is so out of harmony with the rest of the face that the disharmony is instantly noticed. The essential of correction, apart from function, is to restore the nose to a form in which it will *not* be noticed, because it conforms to the other elements of the facial picture.

THE MECHANICS OF CORRECTION

Mention should be made of the method of approach to the tissues that are to be readjusted as well as to the choice of instruments to be used.

The incision of preference is one just within the nostril and following its curve. From this the necessary separations usually can be nicely effected. The second choice is an incision that frees the columella from the septum interiorly, permitting the retraction of the columella to one side but not disturbing it at the philtrum or above. The columella may be incised vertically on its median line. Finally, if the conditions so warrant, the columella, after being freed from the septum, may be lifted out of the field, following detachment at the philtrum.

LINES OF FORCE

All of these methods of attack permit the application of force on direct lines, that is, with the pressure immediately behind the instrument. Those who prefer to make the incision at the point within the nose where the bones and cartilage join are compelled to use instruments in which the part held by the surgeon is parallel to, and at some distance from, the part actually in contact; this is a serious limitation of control.

The advantage of direct application and perfect control of the knife, scissors and chisel is obvious. Moreover, when the direct line of force is open, one can use the chisel, whereas the indirect method compels the use of the saw. The chisel is much to be preferred; it cuts cleanly, whereas the saw may leave a dust of bone, with possibilities of infection or, inconvenient bone regeneration. If the saw pierces the tissues, there is a jagged wound; a puncture by the chisel is so little to be dreaded that at times such punctures are made deliberately. In regard to circulation and therefore the keeping of a clean operative field, there is no comparison between the use of the chisel and the use of the saw.

REPAIR OF THE SYPHILITIC NOSE

I think it well to repeat that the syphilitic nose is no longer to be regarded as a hopeless condition, a fact of which physicians do not yet seem to be aware.

It has been established that failures in the past were due to nonrecognition of an essential of physiology. For the nasal formation, nature demands a cover, a support and a lining. In the past, the necessity of the lining was lost sight of, and in consequence, the correction failed.

The condition appears in three well defined stages, the first of which is not different from the mild type of "saddle nose." It can be corrected, if concern is always shown as to the lining, by readjustment of the elements or by the supplementary implantation of a cartilage support.

In the second stage, when there has been destruction of all the elements within the nose, the exterior form being maintained, but with accumulations of the scar peculiar to the disease, a sinking at the bridge, backward tilt at the tip and the characteristic facies, the nose can be turned back on itself after the preliminary incisions and retraction, and the diseased tissues underlying the skin cover can be removed. It is true that in some of the borderline cases between this and the third stage, there may be nothing left to form a cover for the nose after the excisions have been made, in which case one must resort to more or less extensive rhinoplasty. Short of that stage, when the excisions within the nose are complete, a new lining can be supplied by means of an epidermic graft. This is held in place by a mold fitted to a dental appliance, whose rigidity, when affixed to the teeth, maintains the graft in apposition with the inner surface of the skin cover. After the lining is thus supplied, the nose is held in its proper form by a hard mold attached to the same appliance. Support is given, after suitable delay, by a cartilage implant taken from the costal crest. The characteristic facies are no longer in evidence.

In the third stage, when the destruction is total and only a gap in the face marks the site of the organ, total rhinoplasty is the only recourse.

For the making of a new nose a method has been devised recently which affords another example of the simplifications spoken of in the beginning of this paper.

With a piece of felt, a pattern is made of the nose as it is intended to be. Allowance is made for the new columella and for an inturn on both its surfaces as well as for turning the material for some distance on the inside of the simulated alae; finally, allowance is made for the exact position the borders are to occupy when the flap to correspond with the pattern is brought to place.

It is plain that when a flap cut to this pattern is sutured with the folds made as designed, there will be a substantial columella, and that the alae will have a lining of full thickness skin. But there would remain a part of the interior of the new nose that would be without a lining. However, as the extent of that surface is clearly indicated when the folds are made in the felt pattern and can be outlined with mathematical exactness when the felt pattern is placed on the forehead, the skin within the borders so outlined can be raised and lined by a full thickness graft while the flap is still in situ. Thus, when the flap is ultimately brought down, the whole nose has a lining; the new nose has a certain stability as well as the correct form, and all that remains is to supply a support later.

VARIOUS AREAS FROM WHICH SKIN MAY BE OBTAINED FOR GRAFTS

The Eyelid.—In passing from the consideration of nasal reconstruction to the field of orbital repair, one's attention is attracted to the properties of two valuable agencies, the full graft of skin from the eyelid and the Thiersch, or epidermic, skin graft.

First, in regard to the skin from the eyelid, the amount of skin that can be taken, without injury, from a sound upper lid never ceases to surprise. From the upper lid of an average adult, one may take, as a fusiform graft, a piece of skin 40 mm. long and half as wide, without producing more than a temporary lagophthalmos, which rapidly disappears under the continuous stretching induced by the motions of the lid. In the lid, it soon becomes impossible to detect the line of reorganization. Such grafts can be cut so as to carry down with them a line of hair from the eyebrow for the replacement of cilia.

The use of these grafts in the repair of the eyelids is obvious. The older textbooks indicate many forms of pedicle grafts for covers of the lids. In theory, these grafts may be successful, but in practice they are too thick to substitute for the skin of the eyelid, itself the thinnest skin found anywhere on the body. A thick skin on an upper lid is itself inhibitive of function and is also a disfigurement. On the less mobile lower lid, the importance to be attached to thick skin is not so great, but skin from the upper lid is nevertheless the best cover for the lower, since color and texture are both the best that it is possible to procure.

Moreover, possibly because this skin is so thin, there is greater assurance of "take" than with any other full thickness skin graft. Recently, I had forty-six successful results in forty-eight cases. This graft heals quickly, and leaves only the barest perceptible scar. It is therefore admirably adapted for covering small defects on the face, and even fairly large ones, if skin from both upper lids is available. If it is used to replace a contractile scar at the canthus, it is not to be distinguished from its surroundings, and as it is the nearest obtainable match for the skin of the face it lends itself to a great variety of uses. Of course, a notably deeper pigmentation, such as is sometimes observed, would render it unavailable away from the orbital area.

The Epidermis.—In the whole domain of reconstructive surgery, there is probably no one aid that is so variously useful as the epidermic graft. In the orbital area, in which thin coverings are so frequently essential, its uses are many. As there is no limit to the amount in which it can be had, there is no surface it does not suffice to cover; so that, whether the problem involves one lid or both or these with a more or less extensive area alongside, the whole can be covered in a single procedure. At the other extreme, it has its place in the covering of the smallest defects, such as those left after the correction of an ectro-

pion. As a lining for the culdesac, it succeeds when all other methods have failed. Since it has neither glands nor follicles, there are none of the annoying sequelae inseparable from the use of full thickness skin in this cavity. As it alone of all grafts "takes" as well on periosteum as on other tissues, the mold on which it is emplaced carries its attachments to the lower level of the bony margin of the orbit; in this way, the stability of the prosthesis by which the eye is afterward simulated is assured. In the upper quadrant it is not carried to the margin, room being left for the emergence of the levator muscle.

This graft is an invaluable aid in connection with radical operations on the antrum. With it the walls of that sinus can be completely lined, with an epithelial covering, and it has been amply demonstrated that its presence effectively prevents the development of the offensive sequelae familiar in these cases.

It is also of great utility in the treatment of disease of the frontal sinuses. Here, however, it is not utilized as a lining for the sinus itself, but to form an enlarged and always open channel through which there is uninterrupted drainage from the sinuses on both sides of the nose.

Contractures sometimes occur following the removal of tonsils, due, no doubt, to some imperfection of the procedure. The epidermic graft is invaluable for the relief of this condition, as it also is when there are epipharyngeal contractures.

This graft serves as an agent of functional restoration within the mouth and externally on any area, however large, for which a cover is demanded. It may serve also in such minute procedures as the provision of an artificial canaliculus when the drainage in the lacrimal part of the lid is occluded. It has been used in the extension of Stenson's duct from the antrum, with which it has become involved after an operation, to another point of discharge. There are situations in which, after removal of contractile scar caused by burns, its use is dictated by the surroundings, and the field of its usefulness is continuously expanding.

While the objection may be raised that the Thiersch graft is not a perfect physiologic substitute for an interior membrane, experience over a long period of years demonstrates that it does serve the purpose with every satisfaction. Its use in lining the culdesac is an example of this. The success with this graft is fortunate, as it would be impossible to obtain any mucous membrane in the quantity required, which is about 9 square inches in a single piece.

However, if the best results are to be had from the epidermic graft, it must be cut to the right thickness, not descending below the level of the papillae; otherwise, there will be complications due to the presence of connecting tissue and to the renewed functioning of glands and follicles.

When the graft is cut as a true epidermic membrane, it may be removed in any quantity and so easily that the mere weight and pressure of the knife act as sufficient anesthesia.

The Mucous Membrane.—When it is necessary to replace the conjunctiva or the vermilion border, the mucous membrane graft, taken from within the lip or from the buccal area, is the material of choice. This, also, should be cut thin and should be held in place by cross sutures emerging on the skin. It has a high assurance of "take."

The Turbinate.—For replacement of the visible ocular conjunctiva, the membrane graft is not so desirable, as it has a tendency to retain its reddish color. The membrane that covers the middle turbinate, which is physiologically correct for use in this situation, is of a more desirable color, and it has lately been adapted to the purpose.

Fascia.—Another material, the uses of which are becoming more familiar in this branch of surgery, is fascia, which also is available in such quantities as may be desired. It has been shown that while a graft of fat, transposed with the idea of filling a depression, may absorb quickly, it is much less likely to do so if the fascia is brought with it. Fascia may be used by itself as a packing under the skin for some of these depressions.

But there are still other uses, of even greater importance, suggested by the high tensile strength of fascia. Thin strips are particularly useful in supplying a mechanical correction for paralytic lagophthalmos. If these strips are looped around the inner palpebral ligament and then drawn out through a channel under the skin to a point beyond the outer canthus, they serve to bring the lids to such a degree of approximation as may be desired.

Again, when the region of the mouth has been distorted, following unilateral facial paralysis, correction can be made by carrying strips of fascia from in front of the ear, through channels under the skin, to points just beyond the philtrum and the median line of the chin and to a third point at the corner of the mouth.

In each instance, the needle carries a strip of the fascia from the point of entry in front of the ear to the place designated. There the fascia is looped over a muscle support; the end is drawn back through the same channel, and the ends are tied. To assure stability, the needle bites below the skin in several places, and before the ends are tied there is some weaving of the strands with the tissues in the parotid area. As need for some overcorrection usually is present, other strips of fascia are carried beyond the farther angle of the mouth and are anchored on the nearer side of the philtrum and the chin.

REANIMATION BY STRIPS OF MUSCLE

Incidental to these corrections, the attempt may be made to reanimate the muscles of the orbit and the mouth as an alternative to anastomosis of the facial nerve with the hypoglossal or the accessory nerves. In the correction of lagophthalmos, strips of the temporal muscle are turned on a pedicle and mortised in the strands of the orbicularis and frontal muscles. In the correction of distortion of the mouth, strips from the masseter muscle are similarly turned and mortised among the strands of the zygomatic muscle, the labii superioris, and at the angle of the mouth.

ROTATION OF THE FACIAL SKIN

A development of importance is the realization that by free undermining and advancement of the skin of the face, many defects, even extensive ones, to which formerly skin from another part would have been brought either as a free graft or as a flap with a pedicle, can be covered. An evident advantage is that the new cover is of the same color and texture as the rest of the facial skin. A second advantage is the minimal vascular disturbance. As the advancement is best made following the arc of a circle, the liberating incisions are made in that form, with small angular excisions at the ends. The undermining also proceeds outward by concentric arcs from a point on the face. Suturing begins at the point farthest from the part to be covered, the threads entering the host a little higher than in the undermined skin, with occasional angular excisions to accommodate the apposition of the shorter with the longer arc.

LESIONS NECESSITATING GRAFTS

Burns.—When the skin has been extensively burned and a long interval has elapsed, with the inevitable development of contractures, removal of the contractile tissue and replacement by skin brought from other parts offer the only hope of relief. Free full thickness grafts, pedicle flaps from nearby areas, tubed pedicles taken from distant parts of the body and undermining and advancement of the skin, with occasional resort to the epidermic graft, all are at the choice and judgment of the surgeon. It is worthy of remark that the latest investigations into the means of saving life after devastating burns indicate the benefit of immediate, even if temporary, skin grafting following débridement.

Surgical Defects.—There is an everwidening field for the application of these methods to the covering of defects left by surgical excision. This is true particularly in the field of neoplasms. The possibility of immediately covering such defects will warrant excisions of a magnitude the very nature of which would formerly have been held as a bar

to the procedure. When tissue is eliminated by the method of diathermy, immediate covering may not be so important, but the knowledge that the defect can be covered is a distinct encouragement.

An Empty Orbit.—It is possible, for example, to provide an acceptable covering for an orbital cavity from which all the tissues have been removed. From a point high up on the neck a flap is designed downward, widening as it descends. First, the wide lower end is divided and the ends are tubed; then the main pedicle is tubed. The lower tubes are brought up and affixed to the orbital margins, the line of division between them being made to conform to the palpebral fissure of the sound eye. It will be noted that, by the tubing, a lining as well as a cover has been supplied. Later, a symmetrical opening may be fashioned on both sides of the fissure line, and the leaves of the lids may be prepared for the reception of a prosthesis.

FUNCTIONAL RESTORATION

Finally, it should be borne in mind that function is the main concern in all efforts at restoration, and that function and appearance are closely related. Impairment of function detracts from the appearance, and improvement of function carries with it esthetic betterment. I do not mean to say that appearance is unimportant. The losses with which one is concerned are not necessarily confined to the tissues. Loss of work, loss of the prospect of marriage, loss of social contact, all may be involved. Intelligent use of the resources that have been described may change the whole course of a life. When the epidermic graft is applied as a buccal inlay, trismus can be relieved; if necessary, this graft can be made to replace contractile scar over any facial area, however large. The mucous membrane graft will serve to supply a vermilion border for the lips; the harelip yields to a combination of reconstructive methods; even an otherwise inoperable palate can be reconstructed by resort to the tonsillar tissues, which harden in the new relation. In short, it may be said with confidence that there is no functional aberration, in relation to the face, that is not susceptible of improvement by the judicious application of these methods.

RESPECT FOR THE TISSUES

If there is a secret of success in these operations, it is that one must know the tissues and respect them if with their aid one is to obtain the results desired. The skin, for example, must be thought of microscopically, not macroscopically. One should not expect the tissues to tolerate foreign bodies to which they are known to be intolerant. Infection and stasis must be guarded against, for both are destructive.

KELOID SCARS

As soon as possible, the tissues should receive the benefit of light and air, and in the correction of one disfigurement, one must strive to avoid the production of another.

One of the anxieties inseparable from this form of operation is the angry appearing hypertrophied scar which may develop.

It would seem that this condition may be due, perhaps primarily, to the liberation of toxic properties, the nature of which is as yet unknown, from the cells that are destroyed by the actual incision.

A disposing cause must also be the failure of the disturbed vessels to carry off these or other noxious products of cell life. It is agreed that when for any reason the cells present in the circulation are held stationary, others accumulate around them, the cells die, and inflammation results.

That there should be such blockages at or near the line of the wound of an incision is easy to believe.

Relief for the condition actually is given when hygroscopic threads are passed through the skin at different levels, the intermediate one being at the level of the papillae. The threads act as drains, and blanching and reduction are soon observed.

Minimal dosage of the roentgen ray then prepares the affected skin for excision, after which recurrence seldom takes place.

It has been found that there is an advantage in departing from the straight line in incising and approximating in these scars. The Z incision appears to give the best results, perhaps by distributing the strain.

If the formation of keloids cannot always be prevented, they can be checked by the introduction of hygroscopic threads that relieve the stasis of toxic liquids and by the timely application of judicious irradiation. These are the axioms and postulates on which success depends.

HYPERESTHETIC RHINITIS

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A review of the literature concerning the noninflammatory nasal conditions reveals such a bizarre mass of data that one not only is overwhelmed by the varied etiologic and therapeutic factors described, but is even confused by the nomenclature. St. Clair Thompson [1] has indicated that rhinitis means inflammation of the nose, which is never present in these conditions, and that the terms vasomotor, hyperesthetic, spasmodic or nervous postulate etiology which is not conclusive or constant. From this inchoate mass of literature a selection of various methods of therapy based on described etiology has been made. The different methods of treatment have been applied to a series of patients which was in no way selective. The conclusion drawn, namely, that no matter what is done some cases of hyperesthetic rhinitis will clear up, will be made apparent by the case reports and comments which follow.

REPORT OF CASES

CASE 1.—A man, aged 25, doing office work, had been inconvenienced for the past five years by spasmodic attacks of sneezing, followed by a profuse watery discharge and blocking. Examination revealed a pale, water-logged nasal mucous membrane which was otherwise normal. The blood calcium was 9.7 and the basal metabolic rate + 9. A diagnosis of hyperesthetic rhinitis was made. Calcium, thyroid, parathyroid and ultraviolet irradiation were prescribed, according to the method of Novak [2] and Hollender.[3] The patient, apparently responding to the therapy, has been free from symptoms for fourteen months. This case illustrates the value of therapy based on a hypothesis that hyperesthetic rhinitis is due to a deficiency in blood calcium with metabolic disturbance such as a thyroid dyscrasia.

Blood chemistry and metabolic examinations were made on a number of patients, but it was not possible to establish any abnormal evidence which would serve to substantiate this hypothesis. The metabolic rates in these patients showed the normal variations which one would expect in any group of persons who were or were not suffering with nasal disease, a conclusion reached by Sonnenschein and Pearlman.[4] Some showed

1. Thompson, St. Clair: J. Laryng. & Otol. **38**:28 (Jan.) 1923.

2. Novak, F. J., Jr.: Wisconsin M. J. **19**:534 (March) 1921; Ann. Otol. Rhin. & Laryng. **36**:829 (Sept.) 1927.

3. Novak, F. J., Jr., and Hollender, A. R.: Influence of Ultraviolet Irradiation on Calcium Content of Blood Serum in Hay Fever, Hyperesthetic Rhinitis and the Asthmas, J. A. M. A. **81**:2003 (Dec. 15) 1923.

4. Sonnenschein, Robert, and Pearlman, S. J.: Calcium and Parathyroid Glands in Relation to Hyperesthetic Rhinitis, J. A. M. A. **83**:1973 (Dec. 20) 1925.

low metabolic rates, some high and others normal, so that conclusions concerning the relation of the body metabolism to hyperesthetic rhinitis could not be drawn. Two cases of myxedema with the usual low metabolic rate were observed in which nasal disease was not found; several cases of hyperthyroidism with high metabolic rates have been observed in which nasal disease was not found. The blood calcium in all patients examined has been found normal. This one case, however, cleared up under the empiric use of the described specific treatment. Whether the result was due to the depressant action of the calcium or to the psychic effect of the treatment, or whether the condition would have terminated at this time without therapeutic measures, cannot be ascertained. It does not seem plausible that there is sufficient evidence to conclude that these nasal troubles result from disturbed metabolic conditions, and, thence that calcium therapy is a specific method of treatment.

Case 2.—A woman, aged 37, a housewife, complained of persistent block, watery discharge and sneezing. Examination revealed a pale mucous membrane with ethmoid polypi on both sides. A bilateral ethmoid exteneration was performed, and both sphenoids were drained. The patient made an uneventful postoperative recovery and has been free from sneezing and discharge for fifteen months. This patient is representative of a class of persons in whom correction of some gross pathologic or anatomic condition results in permanent relief.

In such a case, when polypi and ethmoid disease are found, the question arises whether the condition is a true hyperesthetic rhinitis or whether the hyperesthetic symptoms are merely superimposed on the hyperplastic process. The pathologic observations are of interest in that in conditions of polypoid degeneration eosinophils are found in the nasal mucous membrane, a condition which is constant in hyperesthetic rhinitis. The eosinophils in asthma and the relation of ethmoid conditions to asthma are also of interest. With the single exception of polypoid ethmoid disease, operative intervention in these conditions does little good. In cases in which a submucous resection or turbinectomy is performed, results of a temporary nature often ensue, probably because of the disturbance of circulation resulting from the operative procedure, but a return of symptoms sooner or later always occurs.

Case 3.—A girl, aged 19, a student, had suffered with sneezing, nasal hydrorrhea and block for seven months. The usual picture of hyperesthetic rhinitis was found on examination. Injection of alcohol into the nasal branch of the fifth nerve, as described by Stein,[5] was carried out, and resulted in a complete cessation of symptoms. There has been no recurrence in eleven months.

In other patients presenting the same symptom complex and pathologic condition, nerve block failed completely. In persons in whom

5. Stein, Otto: Illinois M. J. **42**:22 (July) 1922.

injections were made in the mucous membrane of the septum and turbinals, temporary relief usually followed. The relief lasted as long as the desensitizing effect of the alcohol on the mucous membrane was effective, much in the manner in which temporary results are obtained by chemical or physical cautery of the so-called "trigger areas" of the mucous membrane of the nose.

Trichloracetic acid applied to the anterior tips of the middle turbinals, the lower margin of the inferior turbinals and the triangular cartilage of the septum often affords relief which may last for several months. Actual cautery of the same areas gives results of a slightly more lasting nature, but there is usually a return of symptoms. In patients in whom repeated cautery was performed the periods of relief became progressively shorter after each cautery until finally no relief was obtained.

CASE 4.—A woman, aged 30, doing office work, showed the usual evidence of hyperesthetic rhinitis. The blood calcium and the metabolic rate were normal. The patient was given 10 cc. of a 10 per cent solution of calcium urate intravenously; in all, five injections were given at forty-eight hour intervals. This patient has been symptom-free for eighteen months.

Seven other patients apparently responded to this therapeutic measure. The results in these cases may have been due to the depressant action of the calcium, or they may have been merely the result of psychotherapy. To substantiate the latter theory, one case can be cited of a person who became symptom-free following an intravenous injection of sterile water.

Another remarkable result from intravenous medication was reported to me. Through a mistake, 10 cc. of a 1 per cent solution of procaine hydrochloride containing 15 minims of a one-ten-thousandth solution of epinephrine hydrochloride was injected into the blood stream. The patient did not show any toxic symptoms and, much to the surprise of the rhinologist, reported immediate and permanent relief from all nasal trouble. The epinephrine hydrochloride may have been a factor in this instance, but since the results were prolonged, something more than the drug action of the epinephrine hydrochloride must be considered.

To further substantiate the likelihood of a psychic element being a direct etiologic factor in the production of hyperesthetic rhinitis, case 5 is cited.

CASE 5.—A young woman complained of a profuse watery nasal discharge of six weeks' duration which made its first appearance while she was on her bridal tour. A boggy nasal mucous membrane was found on examination. On questioning it was found that her marital relations were not normal; on account of this she was in a highly emotional state. A correction of the situation resulted in complete relief of the nasal trouble.

A case somewhat similar was that of a young woman who developed typical symptoms and characteristics of hyperesthetic rhinitis during an

emotional upset due to marital difficulties of other than a sexual nature. Following a divorce the nasal condition cleared up.

CASE 6.—Patient 6 is representative of a number of young women who suffer with nasal hydrorrhea and who show typical evidence of hyperesthetic rhinitis. These young women showed definite skin reactions to orris root and became symptom-free after they stopped using a face powder which contained this root.

Protein sensitization has been attributed as the causative factor in hyperesthetic rhinitis by various authors.[6] Therapy based on both specific and nonspecific protein reactions has been developed by these authors. The case cited was one of specific protein sensitization in which no effort at desensitization was necessary, as the irritative protein could be removed. In cases in which this procedure is impossible, as in cases of sensitization to pollens, desensitization must be attempted, and the results are seldom striking. Nonspecific protein therapy was attempted in nine cases with a questionable result in one and an apparent complete success in another. Intramuscular injections of peptone, as described by Jens Kragh,[7] were used in these cases. Results were not obtained by the feeding of peptone by mouth, as described by the same author, and the intravenous injections with their violent reaction did not give any better results than the more simple intramuscular instillations.

I also had experience with the use of bacterial protein in the treatment of four of these patients. Recently, Gottlieb[8] reported the use of autogenous vaccine of gastro-intestinal origin, with favorable results. No experience with vaccine of this type can be cited, but both autogenous vaccine of nasal origin and stock vaccines of the polyvalent type have been used. The results have not been satisfactory, and in one instance unpleasant complications ensued, resulting in a mild anaphylactic reaction. Since hyperesthetic rhinitis is not a pathologic condition of an infectious nature, the production of this condition owing to infection can be attributed only to the action of bacterial toxins of an endogenous or exogenous nature. Until further work has been done I do not believe that it is advisable to use vaccines in the treatment of these hyperesthetic conditions.

CASE 7.—Representative of a far too large number of cases which have come under my observation is that of a young woman doing office work, suffering from rhinorrhea and sneezing. Rhinologic examination revealed the usual picture

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6. Shea, J. J.: J. Tennessee M. A. **14**:218 (Oct.) 1921. Rich, H. M.: Laryngoscope **32**:510 (July) 1922. Kragh, Jens: Ugesk. f. Laeger **86**:122 (Feb. 7) 1924. Van Leewen, Storm: Ztschr. f. Immunitätsforsch. u. exper. Therap. **40**:552 (Aug. 12) 1924.

7. Kragh, Jens: Ugesk. f. Laeger **85**:339 (May 10) 1923.

8. Gottlieb, M. J.: Laryngoscope **37**:719 (Oct.) 1927.

of a pale water-logged mucous membrane with no anatomic disease. Local treatment, calcium therapy, the injection of nerves, desensitization, cautery, etc., have all been tried and all have failed to give relief.

CONCLUSIONS

1. As yet there is no specific treatment for hyperesthetic rhinitis.

2. No matter what is done, some cases of hyperesthetic rhinitis clear up.

3. No matter what is done, some cases of hyperesthetic rhinitis do not clear up.

30 North Michigan Avenue.

A NEW AID IN THE DIAGNOSIS OF MASTOIDITIS *

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It may be of interest to know what induced us to institute the investigation which we are reporting here. Some time ago, a woman, aged 52, came to us with a moderately acute inflammation of the middle ear. The landmarks in the tympanic membrane were not obliterated, and we did not feel that there was any indication for myringotomy. During the course of our observations, the evidences of inflammation of the ear disappeared. The light reflex returned, and the hearing became acute. The congestion about the hammer handle disappeared. Three weeks after the condition of the middle ear had returned to normal, the patient came back to the office with a tender, edematous swelling near the posterior border of the mastoid. At the operation, pus could not be observed macroscopically in the mastoid cavity. There was, however, a large erosion of bone; the sinus for an area of at least 1 and 0.5 cm. was covered with granulations, and these granulations projected through the mastoid cortex. There was not any evidence of discharge through the eustachian tube. From a piece of bone obtained from the mastoid cavity *Staphylococcus aureus* in pure culture was grown. Following this observation, it was logical to conclude that the bone which had manifestly been destroyed and absorbed must first have been rendered soluble or finely comminuted before its absorption, and if the bone were rendered soluble in the process of its absorption, then some chemical evidence of destroyed bone should be found in the discharge coming from the mastoid through the ear. Therefore, we began to study the calcium content of pus from bone. We compared the calcium content of pus from discharging ears that showed frank necrosis of the bone with those obtained from pus in which necrosis of the bone could not be determined. So far as we could learn from a study of the literature, examinations with this idea in mind had not been made. Our results have been striking, as will be seen from the accompanying table. The abscesses of the soft parts included pus from the lung, liver, muscle, joint, glands, cervix, fallopian tube and chest.

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* From the Pathological Laboratories and Service of Dr. Friesner, Mount Sinai Hospital.

The following case in which the chemical examination was an important aid in determining the operative indications will serve as an example. A child, aged 8, suffering from an acute otitis media, was admitted to the service of Dr. Friesner at Mount Sinai Hospital. During her first week in the hospital she had a moderate amount of discharge, and some fever; this was followed by a period of two weeks during which she had a flat, normal temperature, a diminishing amount of discharge from the middle ear, no pain or tenderness and no change in the wall of the canal. Evidences of beginning resolution in the tympanum were present. The estimate of the calcium content of the discharge during the first week showed from 13 to 6 mg. per hundred cubic centimeters; during the third week the discharge showed from 21 to 26 mg. On the day on which the calcium content of the purulent discharge from the middle ear was 21 mg., there was a rise in temperature to 102 F., the first time in two weeks that the temperature had risen above 99½ F. Two sets of roentgenograms during this period showed a haziness, without evidence of destruction of the intercellular septums. Results of examination by the pediatricians were negative. The status at the end of the third week was as follows: The child felt well, but looked pale; the hemoglobin content

Calcium Content of Pus

Type of Case	Number	Mg. Calcium per 100 Cc. Average	Range
Abscess of soft parts	26	7.7	3 to 13.4
Suppurative adenitis	2	6.5	3 to 10
Chronic sinusitis	10	8.8	5 to 12.5
Purulent otitis media	17	9.6	4 to 15
Acute mastoiditis—necrosis of the bone	24	33.0	21 to 58
Osteomyelitis of long bones *	6	24.0	18 to 32
Chronic arthritis and fisutla (tooth)	1	26.0	
Perforated frontal sinusitis	1	20.0	
Testicular abscess †	1	18.0	

* Pus admixed with blood.
† Semen contains over 20 mg. of calcium per hundred cubic centimeters.

was 65 per cent. She did not have any pain or tenderness, and she ate well and slept well all night. There was a scant discharge from the middle ear, the drum was flat with the short process, and the light reflex was definitely present. The discharge and the entire posterior half of the drum pulsated. The hearing in the affected ear was much poorer than it should have been with the manifestations of resolution in the tympanum. With these indications, and an unexplained fever for three days, we felt that we were dealing with a deep-seated focus in the mastoid. On the morning of the day on which the operation was performed, the discharge from the ear contained 26.6 mg. of calcium. Not only did the operative observations warrant intervention, but the increasing calcium content of the pus was probably explained by the presence of a considerable amount of softening of the bone and pus in the mastoid. The culture showed hemolytic streptococcus.

We could cite a number of instances in which the determination for calcium has run a close parallel to the clinical observations, indicating the necessity for either operative procedure or expectant treatment, and it has helped us make decisions in cases which are clinically doubtful. We have had one case in which pus from a lumbar sinus which had a high calcium content caused the surgeon to suspect the

spine as the focus of infection. On the other hand, in one instance in which the calcium content in a case of suspected mastoiditis was high, the patient recovered spontaneously. The clinical picture in this case did not warrant surgical intervention. Whether there was bony necrosis in the mastoid, or an uncomplicated otitis, is a question that we cannot answer.

The following is an abstract of Kuttner and Cohen's micro-method employed by us, details of which will be published by them in the *Journal of Biological Chemistry*.

SOLUTIONS NECESSARY

(1) Molybdic sulphuric acid mixture.

Dissolve 18.75 Gm. sodium molybdate (Kahlbaum's "zur analyse") in 2.5 nitrogen sulphuric acid. Store in a brown, glass-stoppered bottle.

(2) Forty per cent stannous chloride in concentrated hydrochloric acid. Store in a brown, glass-stoppered bottle. Dilute one volume of stock solution to 200 with distilled water as needed. Unused portions should be discarded as the diluted reagent is not stable.

(3) Seven per cent trichloracetic acid.

(4) Alkaline sodium phosphate mixture.

Mix equal parts of a 2 per cent solution of trisodium phosphate and 20 per cent sodium hydroxide solution. Calcium free chemicals should be used. Should the calcium precipitate, centrifugalize a small portion after one hour or allow it to settle for twenty-four hours and use the clear supernatant fluid.

(5) Fifty per cent alcohol in water made faintly alkaline to litmus paper with sodium hydroxide.

Any type colorimeter can be used, but the microcolorimeter[1] was employed because of convenience, accuracy and the ability to use small amounts of material and reagents.

PROCEDURE

Two permanent standards are used, (*a*) equivalent to 0.01 mg. calcium, and (*b*) equivalent to 0.005 mg. If desired, color standards may be freshly prepared from standard phosphate solutions, but corresponding amounts should be used.

An accurately calibrated 0.2 cc. standardized pipet is used graduated in hundredths and of a bore sufficiently large for thick pus to pass through, should such be encountered.

Transfer 0.1 cc. pus with an accurate pipet to a small platinum dish; rinse the pipet several times with water, and add rinsings to the dish. Evaporate to dryness, cautiously burn off all organic matter, add a drop or two of concentrated nitric acid, and again ignite in the usual manner. Care must be taken, of course, to prevent spattering during the process, which can be completed in about ten minutes. After cooling, dissolve the precipitate with 7 per cent trichloracetic acid in successive small portions of about 0.2 or 0.3 cc. each. The dish is rinsed down the sides with each portion which is then transferred quantitatively, with the aid of a special pipet drawn to a fine bore at the lower end, to a narrow test tube, measuring 12 by 120 mm. The total volume should not be much more than 1 cc.

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1. Kuttner, T.: A New Microcolorimeter, J. A. M. A. **65**:245 (July 17) 1915. The colorimeter and glassware are manufactured by E. Leitz, Inc., 60 East Tenth Street, New York.

Add 0.2 cc. of the mixture of alkaline sodium phosphate and set aside for one hour. Centrifugalize three minutes at high speed, and discard the supernatant fluid catching the last drop on a piece of blotting paper. Allow to drain from one to two minutes and wipe the rim of the tube. Wash twice with 1 cc. portions of faintly alkaline alcohol, rinsing the sides of the tube free from phosphates. Drain and wipe the rim of the tube after each centrifugalizing as before.

It is difficult to see the slight precipitate, but this need not cause concern.

Add 0.4 cc. of the molybdic sulphuric acid reagent and dissolve the precipitate; then add 0.5 cc. distilled water. If desired, 0.9 cc. of a diluted reagent may be used in the proportion of 40 cc. of the molybdic sulphuric acid plus 50 cc. of distilled water.

Add 0.1 cc. of the diluted stannous chloride reagent, close the tube with a rubber stopper and invert at once. The reaction is completed in fifteen seconds under optimum conditions, but it is better to wait one minute. Transfer the solution with the aid of the special pipet to the glass-stoppered, graduated diluting tube of the colorimeter and compare with the standards.

Distilled water is cautiously added in small drops until the color matches that of the standard. The figure which the meniscus has reached on the scale is noted. The method of computation using dark standard B in the microcolorimeter is simple. Each division on the scale represents 0.1 mg. calcium in 100 cc. of pus taken for analysis. For example, if the colors exactly match with the meniscus at 56, then 56 divided by 10 equals 5.6 mg. calcium in 100 cc. of the pus taken. If only 0.05 cc. of pus had been taken for analysis, this result must be multiplied by 2. If the color matches the light standard, each division on the scale now representing 0.05 mg. per hundred cubic centimeters, the reading is divided by 20; thus 56 divided by 20 is equivalent to 2.8 mg. per hundred cubic centimeters of pus.

COMMENT

We hope to stimulate others along these lines in order to accumulate a voluminous amount of statistical material. Should we find on the basis of extensive analyses that the high calcium content in pus bears a striking parallel to the presence or absence of necrosis of the bone as it has in our cases, this test may prove to be an absolute indication for operative intervention. In other words, we know that there are undoubtedly cases of acute appendicitis in which the patients recover spontaneously. Nevertheless, it is the consensus of opinion that if there is one pathognomonic sign of acute appendicitis, then, in spite of the fact that there may be spontaneous regression in a few cases, an operation should undoubtedly be performed. Similarly, if a high calcium content in pus proves to be pathognomonic of necrosis of the bone, the danger involved in expectant treatment in such cases may make it advisable to operate, despite the fact that regression occurs in some mastoids in which there is necrosis of the bone.

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OTOSCLEROSIS

A REVIEW OF THE LITERATURE

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For nearly a hundred years otologists have been studying chronic progressive deafness, and though the etiology of other forms of deafness is better understood than it was many years ago, that of otosclerosis still remains unknown. Since 1889, many authors have described cases, including postmortem observations; with the study of the development of the ear and better knowledge of constitutional diseases, this has markedly increased the present knowledge. I shall try to review much of this literature, giving special attention to the etiology and pathology.

ETIOLOGY

Sex.—Practically all authors agree that otosclerosis is much more prevalent in the female than in the male. Of 458 case reports taken from the records of the Royal Academy at Edinburgh, 354 of the patients were females and 104 males. Of 125 patients studied by Stein,[1] 85 were females, 31 of whom suffered from menstrual disorders; in these, the otosclerosis began prior to the twentieth year. Stein asserted that in many cases the onset of the disease can be traced to the first pregnancy, and that after parturition there is usually a marked improvement in the condition for a time, the symptoms becoming more pronounced at the onset of another pregnancy or at the climacteric. He stated that in some cases the disease occurs during the puerperium and the period of lactation, and remarked that septic complications have a particularly evil effect on the course of the disease.

He also pointed out the prevalence of abnormalities about the genital organs of some of the male patients. He found that in nearly every case of otosclerosis the disease is associated with a condition of nervous degeneration, particularly with sexual abnormality, and he reached the conclusion that it is due to disturbances of secretions of the endocrine glands. Frey [2] corroborated these views, observing that physical conditions and somatic strain, namely, severe shocks, were often present at the beginning of a case of otosclerosis or were responsible for the rapid increase in the condition.

Frey [2] found that the otosclerotic soldiers became much worse during the war. The influence of pregnancy on this disease is recognized to

1. Stein, Conrad: Wien. klin. Wchnschr. **38**:111 (Jan. 22) 1925; **38**:136 (Jan. 29) 1925.
2. Frey, Hugo: J. Laryngol. & Otol. **40**:678 (Oct.) 1925.

such an extent that Burger [3] suggested artificial interruption of pregnancy as a prophylactic in some cases.

In discussing the subject, Alexander [4] gave the following indications for abortions: (*a*) Otosclerosis with an unfavorable prognosis; (*b*) otosclerosis with deafness on both sides; (*c*) the second pregnancy in a woman not more than 25 years of age who has otosclerosis; (*d*) otosclerosis associated with unfavorable social conditions. Otosclerosis may occur at any time of life, but in the hereditary type, the symptoms are frequently observed in persons from 18 to 26 years of age.

According to Fraser,[5] it is likely that the onset occurs at about the period of puberty.

Heredity.—While the existence of the hereditary factor cannot be elicited in every case, yet it is present in a great many—according to Gray,[6] in more than 50 per cent of the cases. Fraser [7] remarked that one should never accept the patient's statement that there is no deafness in the family, since some persons seem to feel that they inherit only desirable qualities. Fraser quoted Gray as looking on the human race as a series in the scale with regard to otosclerosis. At one end are found persons in whom there is almost no potentiality toward otosclerosis, while at the other end the potentiality is exceedingly strong; in these, almost no special stimulus is necessary to produce the disease.

Fraser [5] cited Hammerschlag as having traced otosclerosis through two, three and even four generations in the same family. Frey argued that in regard to etiology, everything hereditary must be constitutional rather than local.

Gradenigo [8] studied the occurrence of otosclerosis in more than 500 families, and believed that the disease is transmitted in the three following ways:

1. When the abnormal characteristic is dominant, the disease is never latent; thus, there are no transmitter individuals, and consanguinity of parents is not concerned in the transmission of the disease to the offspring. The disease is transmitted continuously from one affected person to another.

2. When the abnormal characteristic is recessive, it remains latent in persons who have normal characteristics as well; there are transmitters, and consanguinity in such cases is of the greatest significance, since a mating of two transmitters derived from the same family strain may readily occur.

3. Burger, H. Anershan: Acta oto-laryng. **7**:2, 1925.
4. Alexander: Monatschr. f. Ohrenh. **59**:1 (Jan.) 1925.
5. Fraser, J. S.: Laryngoscope **33**:177 (March) 1923.
6. Gray, quoted by Fraser, J. S.: Laryngoscope **33**:891 (Dec.) 1923.
7. Fraser, J. S.: Laryngoscope **33**:891 (Dec.) 1923.
8. Gradenigo, Giuseppe: Riforma. med. **40**:769 (Aug. 18) 1924.

3. The disease may be preponderatingly or exclusively associated with one or the other sex. Among diseases of the ear, otosclerosis presents characteristics of familial transmission and exhibits, as a rule, properties of a recessive characteristic.

Lake [9] believed that heredity in otosclerosis is not proved unless one is prepared to consider all nonsuppurative diseases of the middle ear, not as potential, but as actual, cases of otosclerosis.

Relation Between Congenital Deaf-Mutism and Otosclerosis.—Fraser [5] mentioned patients with congenital deaf-mutism who have been examined and studied by Politzer, Schwabach, Habermann, Pansé, Denker, Alexander, Lindt and Nager, and in whom a focus of otosclerosis was found in the capsule of the labyrinth. Alexander [4] believed that there is a connection between congenital deafness and otosclerosis, that the first rudiments of otosclerosis are often of congenital origin, and that the ankylosis of the stapes and the atrophy of the sensory epithelium are secondary.

Fraser [5] quoted Koerner as believing that otosclerosis is due to certain determinants in the parents, but that it is influenced by puberty, parturition, the climacteric and also by diseases of the ear. He quoted Manasse as having shown that the changes in the nerve are the same in otosclerosis and in pure nerve deafness. Fraser pointed out in his paper on this subject that it is known that there are cases of atypical otosclerosis in which functional examination apparently shows pure nerve deafness but in which microscopic examinations reveal a typical focus in the capsule of the labyrinth.

In writing on the hereditary weakness of the ear in his paper on deaf-mutism, Fraser stated that the changes found in chronic congenital deafness are similar to those seen in labyrinthine deafness. He [5] quoted Gowers as having described the condition of abiotrophy in which there is a want of nervous energy to bear the strain of normal or functional activity. He mentioned such conditions as progressive muscular atrophy, primary optic atrophy and progressive nerve deafness in this category, and cited Goerke as wishing to add otosclerosis to the list. He quoted Hammerschlag as pointing out that there are families in which cases of both hereditary deafness and otosclerosis are found, and he said that he regarded otosclerosis, progressive nerve deafness and hereditary deaf-mutism as different manifestations of the same hereditary disease.

Toxic Influences.—Several of the earliest authors associated constitutional diseases with toxic conditions as a cause of otosclerosis. Some believed that syphilis was a specific cause (this has now been disproved), while others pointed out the influence of gout and tuberculosis; recently

9. Lake, R.: J. Otol. & Laryng., August, 1925.

authors have stated that the toxins from focal infection and disturbances of the ductless glands are causes of this disease.

It is conceded by most authors that all these factors have an unfavorable influence on the course of the disease, but it remains to be proved that any one is a specific cause.

Endocrine Disturbances.—Stein [1] believed that otosclerosis is due to disturbances of the endocrine glands, since nearly every case is associated with nervous degeneration. In 1910, Frey [10] came to the conclusion that otosclerosis must not be considered as a local condition, but that it must be regarded as related to the general constitutional condition of the patient, especially as regards disturbances of the endocrine glands. Frey enumerated the following reasons for his belief:

(*a*) Otosclerosis is hereditary.

(*b*) The female sex is especially affected, and the disease becomes worse at puberty, pregnancy and the climacteric.

(*c*) The physical conditions and somatic strain are often present at the onset of a case.

(*d*) The vasomotor system is involved in otosclerosis, and this system is of course related to the ductless glands.

(*e*) Otosclerosis is sometimes combined with other abnormalities, such as fragility of the bones and blue sclerotics.

(*f*) Chemical investigations have shown that all otosclerotic patients suffer from a diminished calcium content of the blood.

Frey [2] held that otosclerosis is related to diseases of the parathyroid gland.

Delie [11] stated that the developmental fault of the capsule is caused by an error in its blood supply, which is controlled by the cervical sympathetic system.

Paresis of the sympathetic system causes dilatation of the blood vessels, slowing of the circulation and malnutrition of the parts supplied.

Sympthicotonia or hypothyroidism causes hypertension of the vessels and diminution of the secretions. The suprarenals raise the blood pressure, but the action of their secretion is balanced by the action of the thyroid extract which lowers the vascular tension.

Delie [11] described the appearance and characteristics of otosclerotic persons—the dry skin, calm temperament and dull mentality—and likens them to those suffering from hypothyroidism. After reviewing the conditions in regard to the endocrine balance at puberty, during pregnancy, lactation, after castration or oophorectomy, he concluded that otosclerosis is the result of hypothyroidism.

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10. Frey, Hugo: J. Otol. & Laryng., Oct. 26, 1926, vol. 41.
11. Delie, A.: Ann. d. mal. de l'oreille, du larynx, May, 1923.

After studying carefully, both aurally and as to basal metabolism, five patients suffering from this disease, Jousseume [12] placed his observations and conclusions under the following headings:

(*a*) Nearly all cases of otosclerosis occur in women, and the ductless glands cause far greater metabolic fluctuation in women than in men.

(*b*) Development of otosclerosis varies with the activity of the ovaries, though the author stated that the pituitary gland has an even closer association with otosclerosis.

(*c*) The disease is both symptomatic and systemic, both ears usually being affected; the condition thus resembles rickets, osteomalacia and acromegaly.

(*d*) Jousseume's [12] patients did not have catarrh of the middle ear, diseases of the nose or throat or evidence of rheumatic or diabetic diathesis. The disease is most frequently hereditary.

(*e*) In all five patients, the basal metabolism was definitely low. All the patients were females, and four of the five were between the ages of 14 and 16; in only one was the menstrual flow normal in quantity.

In a study of more than 100 cases in which otosclerosis was associated with the disturbed function of the endocrine system, Drury [13] stated that he had found that fully one third of all of the cases gave neither subjective nor objective evidence of endocrine disturbance. In the remaining two thirds of the cases cited, endocrine foci, including those in the thyroid and the pituitary glands and in the gonads, were more or less definitely incriminated. Drury concluded from these studies that the endocrine influence is indirect and not specific, and stated that the endocrine system plays a most important part in the general regulation of the body metabolism. He pointed out that the functional failure of any endocrine element, as well as disturbances of a nonendocrine origin, may upset the myriad of delicately adjusted equilibriums and produce otosclerosis; he also asserted that there must be a constitutional element, a diathesis, a tendency, as this is intrinsic in the facts which have been demonstrated that all patients with endocrine disorders do not exhibit otosclerosis nor do all patients with otosclerosis have endocrine disorders.

Blood Chemistry.—Lecher [14] asserted that there is a similarity in the analysis of blood serum in otosclerosis and in cancer. He found that the calcium content of the serum was slightly lowered. Of 300 patients with otosclerosis studied, 80 per cent showed a calcium content between 9.9 and 10.8. The sugar tolerance was lowered in both conditions. Cholesterol in the serum was less than normal in both diseases, while the albumin-globulin ratio showed a relative increase in globulin.

12. Jousseume, R.: Ann. d. mal. de l'oreille, du larynx, May, 1923.

13. Drury, Dana: Ann. Otol. Rhin. & Laryng. **35**:651 (Sept.) 1926.

14. Lecher, H.: München. med. Wchnschr. **72**:762 (May) 1925.

Lecher observed that the symptoms are similar to those observed in other conditions and are in no way specific, but are worthy of comment.

Berberich [15] determined the blood cholesterol in thirty patients with otosclerosis, twenty-nine of whom gave low figures, from one half to one tenth of the normal. Two of the patients were near the term of pregnancy, when cholesterols normally increase in the blood and disappear from the ovaries. Berberich quoted Fleischmann as having found similar low cholesterol figures in patients with ozena.

Kopetky and Almour [16] investigated the calcium content of the blood in patients suffering from various forms of deafness, most of whom had otosclerosis. Fourteen of the twenty showed a decrease in blood calcium—ten of these had otosclerosis. The authors regard an alteration of calcium content in the blood examined after a fasting period of several hours as strong evidence of the presence of otosclerosis in the patient who shows loss of hearing and who presents a history of deafness in one or more blood relatives.

In cases of active rickets, observations, on the blood, in which the phosphorus content is lowered, led Kauffmann [17] to believe in the empiric use of cod liver oil. He reported temporary improvement in some patients.

Developmental Features.—Fraser quoted Gray [18] as believing that otosclerosis is a developmental variation, and that such variations are more likely to occur in organs which are of comparatively recent origin, such as the cochlea, than in those which are of more ancient descent, as the vestibular apparatus.

For this reason, the margin of the oval window, the footplate of the stapes and in some cases the nervous structure of the cochlea are affected, while other parts of the labyrinth are untouched. In commenting on the association of otosclerosis with fragilitas ossium and blue sclerotics, Fraser further remarked that he has examined three patients with these conditions, all from one family; in pointing out congenital weakness of mesoblastic tissue, he stated that all three structures—the labyrinth capsule, the long bones and the sclerotics—arise from the mesenchyme.

Cleminson [19] described a case in a girl who became deaf at 13 and who had four fractures of different bones, one at 3 years, one at 12, one at 15 and another at 16 years of age; the sclerotics were blue.

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15. Berberich, J.: Klin. Wchnschr. **3**:2003 (Oct. 28) 1924.

16. Kopetzky, S. J., and Almour, R.: Blood Calcium in Undifferentiated Deafness, Arch. Otolaryng. **1**:473 (May) 1925.

17. Kauffmann, A. B.: Laryngoscope **32**:50 (Jan.) 1922.

18. Gray: Tr. Otol. Soc. United Kingdom, vol. 7, pp. 76 to 79.

19. Cleminson, F. J.: J. Laryng. & Otol. **42**:168 (March) 1927

He mentioned a family of fourteen persons described by Dighton, nine of whom had blue sclerotics; one of these became deaf after confinement.

Cleminson [19] mentioned the Currie family of fifty-five members, twenty-one of whom had blue sclerotics; twenty had fragilitas ossium and seven of the twenty-one were deaf.

He quoted Fraser as having examined three members of this family who were found to have otosclerosis.

Cleminson cited Nager and Ruttin as having made similar observations and having been able to study sections post mortem; Cleminson presented one of these and concluded, as did Fraser, that the three constituent symptoms are all due to disturbances in the development of the mesenchyme, from which the bones and fibrous tissue, including the sclerotics, are developed.

RELATION OF OTOSCLEROSIS TO OTITIS MEDIA

Lake [9] questioned the correctness of regarding otosclerosis as a distinct disease, and, as mentioned before, questioned the factor of heredity as being proved unless one is prepared to consider all nonsuppurative infections of the middle ear, not as potential, but as actual otosclerotic, cases. Further, he mentioned such conditions as rheumatism, gout, anemia and rickets as contributing factors in otosclerosis, since they all are associated with sepsis, as diseases of the midle ear so often are. He further pointed out that Bezold's triad is also found in other conditions, such as chronic catarrhal and tubal obstruction and suppuration of the middle ear.

Fraser [7] pointed out that almost all children have had an attack of earache at one time or another, so that it is impossible to exclude otitis media as a cause of otosclerosis. He thought that the presence of normal drum heads does not exclude the possibility of otitis media as an etiologic factor, but he did not claim that otitis media explains everything.

He likened the relationship of otitis media to otosclerosis to the relationship of bronchitis to bronchiectasis or of purulent rhinitis to ozena. He seemed to believe that otitis media and congenital weakness are the most logical etiologic factors. He quoted Lucae as stating that a sharp line cannot be drawn between chronic catarrh of the middle ear and otosclerosis, and further quoted Alexander: "We know that some cases of otosclerosis follow otitis media. The question is, do all cases?" In his paper on chronic progressive deafness, Emerson [20] favored the rhinologic rather than the otologic factor, and claimed that:

20. Emerson, Francis P.: Ann. Otol. Rhin. & Laryng. **33**:865 (Sept.) 1924.

(*a*) There is no method in differentiating between deafness due to degeneration of the nerve and that due to toxemia.

(*b*) The eustachian tube is always more open on the side of the deaf ear, if syphilis, cerebrospinal meningitis, mumps and traumatism are excluded as the exciting causes.

(*c*) Chronic deafness is not a steady loss of tone perception, but follows acute exacerbations of a local focus; it is stationary until the next toxic invasion, and evidence of the local process is always present until extreme old age.

OTOSCLEROSIS IN THE ETIOLOGY OF PROGRESSIVE DEAFNESS

According to Shambaugh and Holderman,[21] there are no means of diagnosing otosclerosis by functional tests alone, when the spongifying of the labyrinth capsule develops in the region of the oval window; the first evidences of a defect in hearing are those resulting from fixation of the stapes or Bezold's triad. These results correspond exactly with those in other pathologic processes, resulting in fixation of the sound conducting apparatus.

Again, spongification of the capsule may occur in an area remote from the oval window.

Cases in which deafness of the middle ear is present are less difficult to diagnose, and, according to postmortem examination, are most frequent.

In cases in which the tube is patulous and the drum membrane normal, the diagnosis seems assured.

In the second type of otosclerosis, the functional symptoms, verified at autopsy, may be typically those of primary nerve deafness. More extensive postmortem study in cases of primary nerve deafness, especially when (*a*) deafness begins in early adult life, (*b*) when there are other cases of genuine otosclerosis in the family (*c*) and when no other probable cause of nerve deafness can be found may show that otosclerosis is more frequently the cause of deafness of the inner ear than is now suspected.

Shambaugh [21] admitted that otosclerosis may develop in patients with evidence of tubotympanic changes, though the diagnosis is difficult. He concluded that there is no evidence that the changes produced by a previous tubotympanic process hinder the development of otosclerosis or that the presence of these two processes in the same case indicates that the spongification has been the result of the previous disease of the middle ear.

Roentgen-ray examination of the mastoid in patients with otosclerosis in whom the drum is normal has shown a complete pneumatiza-

21. Shambaugh and Holderman: Tr. Am. Otol. Soc., 1926, vol. 17.

tion of the mastoid, though occasionally arrested pneumatization has been found in some patients with otosclerosis.

Shambaugh attached the same importance to arrested pneumatization as to the changes in the drum membrane; both indicate previous disease of the middle ear, but neither is related to the development of otosclerosis.

He also thought that transparency of the drum head is not indicative of any pathologic change. Of 113 patients examined, ninety-two had normal drum membranes, and in twenty-one a diagnosis of fixation of the stapes was made in the presence of alterations in the drum membrane, indicating an exhausted tubotympanic process. In fifteen cases, the pinkish glow came from the promontory. In 105 cases the functional reactions were those of fixation of the stapes, though occasionally extensive involvement of the internal ear was found also.

The other eight patients gave the reactions of primary nerve deafness; some of them showed the flamingo tinge on the promontory.

Paracusis was present in sixty-four cases and vertigo in six. When paracusis was present, the patient could hear well over the telephone.

Shambaugh and Holderman believed that the ordinary explanation of paracusis is correct, i.e., that the rigidity of the stapes filters out most of the external sounds, leaving perception of the voice unhampered; while a normal person finds difficulty in hearing as the external noises increase.

The ability to hear well over the telephone is dependent on bone conduction, and patients with primary nerve deafness have difficulty in hearing over the telephone.

Most authors conclude that in otosclerosis a change in the pathologic condition cannot be accomplished by treatment.

Otosclerotic persons become the victims of quacks who use radiation, the pituitary body, treatment of the eustachian tube and electrical devices with loud sounds, which frequently produce degeneration of the cochlea.

Shambaugh and Holderman believe that the solution of otosclerosis lies in the perfection of artificial aids to hearing and the prevention of spongification by the discovery of the cause.

RELATION OF HUMERAL DEAFNESS TO OTOSCLEROSIS

Claoué [22] claimed that the rôle of labyrinthine fluids in audition has not received sufficient attention, and he quoted Bezold as having observed a case in which there was a loss of the perilymph through a fistula, with an immediate loss of hearing of low tones, which is supposed to indicate a lesion of conduction. The hearing became normal after an

22. Claoué, R.: L'Oto-rhino-laryngologic internationale, July, 1924.

interval, presumably owing to the replacement of the fluid. Claoué reasoned that as an alteration in the interocular fluids produces great effect on vision, so the changes in the intralabyrinthine fluids produce alterations in hearing, and he likened the ciliary body to the stria vascularis of the labyrinth. He observed that modifications of the labyrinthine fluid produce the same symptoms and signs as ankylosis of the stapes; he further claimed that Gellé's test would be associated with a mobile stapes and a more dense labyrinthine fluid. He further remarked that this possibility may explain cases in which the clinical picture is one of otosclerosis, but in which improvement occurs.

He differentiates this type of deafness by (*a*) an absence of family history; (*b*) rapid onset, and (*c*) diminution or loss of excitability of the vestibular apparatus.

TYMPANIC PRESCLEROSIS OF CITELLI

Calderin [23] described tympanic presclerosis of Citelli as occurring in older children with adenoids; it is accompanied by impairment of hearing, which is not improved but is made worse by adenoidectomy. Few local pathologic changes are found to account for the deafness, but usually there is a family history of otosclerosis.

VASOMOTOR DISTURBANCES

Schmierer [24] pointed out that the reddish glow from the promontory at times thought to be pathognomonic of otosclerosis is sometimes seen in persons with normal hearing, especially in degenerates and cretins.

Brunner [25] has done some experimental work on guinea-pigs. He subjected these animals to blows on the head in order to produce concussion with a dilation of the blood vessels of the brain and labyrinth through the circle of Willis; then he killed the animals by bleeding, and examined the ear microscopically. The vessels in the inner ear were dilated with an exudate that stained with eosin and that contained a few leukocytes. The endolymph and perilymph spaces showed hemorrhages and coagulated lymph. The epithelium was intact. Brunner concluded from this that vascular changes may cause organic changes.

PATHOLOGY

According to Kerrison,[26] otosclerosis is a lesion of the bony capsule surrounding the labyrinth, varying in its mechanical results according

23. Calderin: Rev. españ. de laringol. **25**:220, 1924.

24. Schmierer: Monatschr. f. Ohrenh., November, 1924; quoted by Dickie, J. K. M.: Chronic Progressive Deafness, Arch. Otolaryng. **3**:538 (June) 1926.

25. Brunner, H.: Wien. klin. Wchnschr., Nov. 12, 1925.

26. Kerrison: Diseases of Ear, Philadelphia, J. B. Lippincott Company, 1921, pp. 245-247.

to the region chiefly involved, thus producing several forms of deafness. The process is one lacking characteristic features of an inflammation, but consisting essentially of the absorbing of old bone in the region involved and its replacement by new spongy bone. The latter is characterized by haversian canals of abnormal width, large medullary spaces containing numerous multinucleated cells and large, thin-walled blood vessels.

The characteristics of the new bone are its affinity for hematoxylin and carmine dyes and its differentiation by a distinct line from the surrounding healthy bone. It may remain spongy or in time be converted into dense bone. Any part of the labyrinth capsule may be involved, but the area contiguous to the oval window is the most common site.

Siebermann's [27] investigations caused him to decide that otosclerosis was a developmental abnormality; he thought that the process originated, not in the bony capsule, but in the layer of cartilage cells lying between the original membraneous capsule of fetal life and the surrounding bony capsule, later developed from the connective tissue of the skull.

More recently, Gray [18] associated the lesion with failure of the local blood supply, and in this way brought it into etiologic relation with depressed systemic conditions.

He believes that his theory is supported by: (1) The absence of inflammatory action; (2) the absorption of bone and cartilage throughout small circumscribed areas of bone; (3) the deposition of new spongy bone to replace the structures which have been absorbed; (4) the fact that this absorption without inflammatory reaction and subsequent replacement by spongy bone is what might be expected in a tissue in which the local blood supply had failed; (5) the character of the artery supplying the bone, that is, that of vessels incapable of changes of caliber in response to variation in arterial force; (6) the anatomic peculiarities of the bony capsule, i.e., dense bone in which the caliber of the haversian canals is much smaller than in any other bones of the body.

Consequently, Gray [18] believes that when for any reason the arterial force is markedly reduced, or if the quality of the blood is pathologically changed, the conditions become suitable for stagnation of the blood in the vessels of the bony capsule, with a possibly resulting thrombosis.

Mayer,[28] who examined a number of temporal bones at autopsy, classified the disease into the sclerotic and the myeloid type; he subdivided the latter type into fibrous, cystic and vascular types.

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27. Siebermann, quoted by Fraser (footnote 5).

28. Mayer, Otto: Wien. klin. Wchnschr. **37**:131 (Feb. 7) 1924.

The labyrinths showed a condition of hyperostosis, so that the round and oval windows were completely closed. Exostosis was found in the perilymphatic cistern of the cochlea and on the scala tympani, especially in the second turn. Other malformations of the spiral lamina of the cochlea have been found in otosclerosis and still others in a case of deaf-mutism of a congenital type.

In cases of otosclerosis and deaf-mutism, more generalized types of hyperplasia have been seen, and the whole petrous bone hase been found hyperplastic.

Mayer considered that these malformations are of a congenital nature, arising in the primitive capsule of the labyrinth, usually near the round and oval windows and to a varying extent in other parts of the labyrinth.

He believed that these early changes are the foci from which hyperplasia and exostosis develop; he further compared these phenomena with the conditions which arise in other bones of the skeleton not uncommonly affected by exostosis and hyperostosis, but which often have a congenital incidence and, like otosclerosis, have a definite familial history and can be inherited. He consequently believed that the formal development of otosclerosis is clearly one of congenital maldevelopment. There is no apparent connection with osteomalacia and rickets, but there is a definite similarity and correspondence between otosclerosis and the osteitis deformans of Paget, though the lesions of otosclerosis are much more focal than the changes in osteitis deformans.

In another article, Mayer [29] undertook to disclose some fundamental differences between his conception and those of Manasse and Wittmaack.

Resorption of Osteoclasts in the Cement Line.—Mayer claimed that there is no evidence that old bone is mechanically displaced or loosened, as is believed by Manasse. It seems to be proved that the cement line cannot develop in any other way than by cellular resorption.

Reticulate Bone.—In the resorption of bone, is the bone itself actively involved or does it play only a passive part? Manasse, Wittmaack and Eckert asserted that bone is resorbed by the osteocytes of the bone that is stained dark blue in hematoxylin-eosin preparations and that lies inward toward the labyrinth.

Mayer [29] maintained that these properties are ascribed to the osteocytes on erroneous grounds; the irregular distribution of the osteocytes, their situation in pairs in a cavity, their size and jagged form and the clear areola around them prove nothing except that the bone does not have lamellae or parallel fibers but is reticular bone, the characteristics of which include such a condition of the osteocytes, especially while the bone is young.

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29. Mayer, Otto: Ztschr. f. Hals-, Nasen- u. Ohrenh. **3**:187 (Oct. 15) 1924.

The reticular bone develops in the marrow of the connective tissue through the activity of the osteoblasts which excrete a cement substance and thereby enclose themselves and the collagenous fibers.

That the typical bone of otosclerosis, which Mayer calls reticular bone, takes a deep blue stain is attributed to the fact that this tissue is rich in cement substance, which has a great affinity for hematoxylin.

Formation of New Bone in Vascular Canals in the Labyrinthine Capsule.—Mayer [28] discussed the different kinds of formation of new bone in vascular canals, of which he distinguishes four types.

In the first two, preexisting canals are contracted and filled without previous resorption; for this reason, the new bone is separated from the old bone, not by a cement line, but only by a line of attachment.

In the third type, formation of bone occurs after resorption of the old bone in the spaces thus created. This new bone is always lamellar and is separated from the old bone by a cement line.

In the fourth type, an immature reticular bone is formed after previous resorption of the old bone, and is also separated from the surrounding bone by a cement line.

Mayer [28] previously observed this type of new bone only around foci of otosclerosis, and he was able to demonstrate that it was connected with the foci. Later he found such new formations in the labyrinthine capsule, usually at the boundary of the cartilaginous and periosteal capsule.

Fraser [7] remarked that the first stage is a spongification of the bone, with a formation of large spaces containing a central blood vessel surrounded by granulation or connective tissue. The bony walls of this space stain deeply with basic stains such as hematoxylin. Some observers believe that this is newly formed bone; in Fraser's opinion, new bone takes eosin stain, and he thought that the deeply stained bone is merely the old bony tissue the staining reaction of which has been altered by the change it has undergone owing to the vascular dilatation and increased supply of inflammatory lymph.

He further stated that the final stage is one of sclerosis or formation of dense, irregular lamellar bone, which stains with eosin. With regard to osteoclasts, some hold that these cells are responsible for the removal of bone in the early stages, while probably the majority of observers think that osteoclasts appear only at an advanced stage.

In the early period, absorption of bone is probably due to pressure of the newly formed granulation tissue.

Fraser remarked that in cases of tumor of the eighth nerve in whch the internal meatus is greatly dilated, osteoclasts are not found, and he concluded that they are unnecessary for absorption of bone

The process of absorption of bone with the formation of large vascular spaces seems to proceed along the blood vessels as they enter

the labyrinth capsule from the mucoperiosteum in the anterior margin of the oval window. Fraser believed that bony ankylosis of the stapes is probably a late feature of the disease, as it is seen most commonly when the disease is of long duration.

Other parts than the site of election may be involved, such as the cochlear capsule between the lamellar and the cartilage bone to the region of the internal meatus.

Politzer [30] held that the presence of otosclerosis in this situation proved that the disease was not due to otitis media, as mucosa was not present here. Fraser,[7] however, stated that there is a well marked lymph or connective tissue space between the cartilage and lamellar bone in the fetus and in young children, though it is less marked in adult life, along which the inflammatory process may spread.

Fraser [7] quoted Katz as having observed changes in the ossicles in otosclerosis similar to that seen in the labyrinth capsule, while he (Fraser) observed an almost similar condition in the malleus and incus in chronic suppuration of the middle ear; he pointed out that the tympanic ossicles and joints are almost the only bones and joints in the body which are covered merely by mucous membrane; consequently, they are more liable to infection from the surface. He further attributed the weakness around the anterior margin of the oval window to the presence of the tensor tympani tendon or to the greater movement of the anterior part of the footplate of the stapes or most probably to the entrance of vessels from the deep layer of mucosa associated with the presence of strands of fibrous tissue which replace cartilaginous rests seen in the fetus.

This rest of cartilage is connected by a narrow strip to the anterior margin of the oval window.

Fraser quoted Mayer as stating that the island of cartilage may remain unossified until the end of the second year or may never occur, and a medullary space may remain filled with fatty masses.

He further stated that there are two centers of ossification which meet at the site of election, and that these observations support the views of Neumann. He also stated that otosclerosis is a congenital anomaly of the process of growth in the petrous pyramid, which gives rise to symptoms only at the age of puberty; i. e., while the growth of the petrous bone should normally cease in childhood, in otosclerotic persons the growth continues and results in the formation of a vascular spongy bone.

After describing the autopsy in a case of chronic suppuration of the middle ear in which an area of osteitis vascullosa in the capsule of the labyrinth was found on the inner wall of the tympanum in the

30. Politzer: Diseases of Ear, Philadelphia, Lea & Febiger, 1926, p. 331.

anterior margin of the oval window; Fraser [7] traced the spread of the disease in the wall of the labyrinth between the periosteal and cartilage bone around to the region of the internal auditory meatus and also over the apex of the cochlea to the anterior part of the bony capsule of this structure. At the apical coil of the cochlea, the spongification reached the perilymph space.

By calling attention to some features of the development of the ear, he explained how this chronic infective condition which invaded the capsule of the labyrinth from the region of the promontory can reach the internal auditory meatus. At the third month of fetal life, the membranous labyrinth is surrounded by a capsule of cartilage which is later enclosed in lamellar bone formed by the deep layer of the tympanic mucosa and the osteogenetic layer of the dura mater. A lymph space exists between the cartilage bone and lamellar bone for some time after birth. Later, only traces of this space can be seen, but there is always a potential space, and if a chronic inflammatory process involves the labyrinth capsule and opens up this space, it may spread around the cochlea and reach the region of the internal auditory meatus.

TESTS OF HEARING IN OTOSCLEROSIS

Bunch [31] reported the following results in 63 cases which were divided into two groups: typical and atypical.

The typical cases were those in which Bezold's triad was constant. The atypical cases were those in which some irregularity occurred in one or more of these three characteristics.

Of 117 cases in which the Rinne test was performed, 88 showed a typical negative reaction; 4 showed a positive reaction; 29, an atypical reaction and 3, a questionable reaction.

Of 89 cases, 82 showed increased bone conduction, 29 showed decreased bone conduction, 7 were atypical and 2 were normal.

Bunch stated that his results with the Weber test were unsatisfactory. He made one point: he stated that of 14 cases showing unilateral curves of the type indicating disease of the middle ear, none referred the tone to the opposite ear, if the opposite ear showed a curve of the type indicating disease of the inner ear. He concluded that this seems to point to an involvement of the nerve in the opposite ear.

In 87 ears, the Gellé test gave a positive fixation response. It was negative in eight and doubtful or undetermined in 30. Eighty-nine per cent of the typical cases and 83 per cent of the atypical cases gave a positive response.

Bunch [31] used the Edelmann series of forks and with them found that 83 per cent of the patients were unable to hear this fork (50

31. Bunch, C. C.: J. Laryng. & Otol., September, 1926.

double vibrations) at an intensity easily audible to the normal ear at a distance of 4 inches and that 50 per cent could not hear it at all.

Bunch found a marked loss of acuity for the higher musical tones, especially for the C-5 fork 4,096 double vibrations). Fifty-eight per cent of the ears tested were not able to hear this fork when it was sufficiently intense to be audible to the normal ear at 5 feet, and only four ears approached normal acuity of hearing for this fork. Bunch remarked that the acuity of hearing for this fork shows as great a loss as the acuity for the fork giving 50 double vibrations.

The measurements for the upper limit of audibility for bone and air conduction were made with a struycken monochord.[31a] Seventy-five per cent of the ears tested had the upper limit by bone conduction, and 2,000 or more double vibrations above that for air conduction.

In this series of cases, tinnitus was a disturbing factor noted in 88 per cent of the typical and atypical cases. Thirty-six patients reported that the deafness was noted before the onset of tinnitus. In nine cases, the tinnitus appeared before the deafness.

Three types of deafness are described by audiometer curves: (1) the type showing disease of the inner ear; (2) the type showing disease of the middle ear, and (3) the mixed type.

The curve in the type showing disease of the inner ear remains about two steps below the normal line until it reaches a pitch of about 1,000 double vibrations; then it drops almost perpendicularly to the base line, indicating inability to hear the loudest tones of the audiometer, for the upper portion of the range covered by the instrument.

The type showing disease of the middle ear presents a fairly uniform loss of acuity of hearing throughout the entire range of tones covered by this instrument.

In the mixed type, one observes a lowering of the threshold of acuity throughout the entire tonal range, plus a complete tonal gap at 1,600 double vibrations.

From a study of the fields of hearing in these cases, Bunch was led to think that it is possible to secure evidence which may be a basis of a classification which will give some hint of the pathologic condition in the ear in this disease.

The records of thirty-one ears showing disease of the inner ear were characterized by the fact that the curve showed a single more or less

31a. The struycken monochord serves especially for the definition of the perceptivity of hearing the highest tones, that is to say, of the upper aural limit for air and bone conduction, by means of tones of longitudinal vibration. The employment of the instrument also for tones of transversal vibration, according to K. L. Shaeffer, is an innovation of such a value as cannot be fully appreciated; so the monochord forms a continuing row of tones from the C_2 into the upper aural limit. The longitudinal tones of 45 mm. length of the chord harmonizes with the transversal tone 45 mm. length of the chord's length.

extended and depressed island of hearing in the lower portion of the tonal range usually lower in pitch than 1,500 double vibrations. In fifty-two ears showing disease of the middle ear, the curves are all characterized by a more or less uniform depression throughout the entire tonal range. Partial gaps or depressions may appear at any point, and complete gaps, if any should appear, are located in the upper part of the range.

In the third group, Bunch described the records of thirty-eight ears which are characterized by the presence of two islands with an interlying gap which usually appears for tones near 1,500 double vibrations.

The author observed in his group of cases that dissimilar curves in the two ears appeared with greater frequency than did those having similar curves.

The presence of paracusis willisii was noted in thirty-one patients and denied by twenty-three; in five, it was doubtful. It was present in 59 per cent of the type showing disease of the inner ear; in 54 per cent in the type showing disease of the middle ear and in 66 per cent of the combined type.

In a paper by Krantz [32] on paracusis, he described experiments in which he subjected a number of patients with paracusis to various tests with noise-producing apparatus; he concluded that the hearing under these circumstances actually is not better than usual, but that the apparent improvement in hearing is due to the fact that the voice is raised. In addition, the noises are generally sounds of low frequency; consequently, they are unheard by the patients and do not disturb them.

Knudsen and Jones [33] concluded from experiments that whether paracusis is present or not, all persons hear less well in a noisy, than in a quiet, place. This applies not only to pure tones, but to conversations. Thus, patients with paracusis actually do not hear better when there is a noise than when it is quiet, although they often think they do. Paracusis occurs only in patients with a conductive lesion of fairly high degree; they hear the lower tones poorly or not at all; consequently, if the noise is largely of low frequency, it does not disturb a patient with paracusis as much as a person with normal hearing or one with nerve deafness. Thus, in the presence of a noise of a given intensity, the hearing of a normal person may be reduced 30 per cent, while the hearing of a paracusic person will be reduced only 8 or 10 per cent; thus the paracusic person enjoys a relative advantage.

Paracusic persons generally have fairly good hearing for the middle tone ranges, while they hear poorly tones of low frequency. Traffic noises are usually of low frequency; consequently, a normal person raises his voice and the paracusic person hears better than if there was no

32. Krantz, Frederich W.: Ann. Otol. Rhin. & Laryng. **33**:283 (March) 1924.
33. Knudsen, V. O., and Jones, Isaac H.: Laryngoscope **36**:623 (Sept.) 1926.

noise and the voice was at the normal level. The paracusic person, not being disturbed by surrounding noises, does not raise his voice. His own voice also sounds loud to him on account of his conductive lesion.

Gradenigo [34] believed that the power of hearing was not equal along the whole scale of sounds and described defects in the scale as "gaps" or "lacunae." He pointed out that much less energy was needed in the central scale than at the two extremities, and that the most sensitive part of the scale ranges from 2,000 to about 1,500 double vibrations; he divided the gaps that might be encountered clinically into two main groups: (1) those following destructive processes in certain parts of the cochlea and (2) those which do not depend on an inflammatory cause but which have a family degenerative character.

In all Gradenigo's cases, the middle ear was always intact. In the more numerous group of these cases, the power of hearing the upper part of the scale was lacking, although it was well preserved for the lower part of the scale. The sense of hearing stopped sharply within a limit of between 1,000 and 500 double vibrations; it was completely absent above this limit. In other patients, there was a complete loss of hearing for the lower end of the scale as well.

In the second group of cases, hearing was lacking for a small area at the superior extremity of the scale, from 400 to 600 double vibrations, and in a third group there was a circumscribed gap between 1,500 and 3,000 double vibrations, with hearing for the rest of the scale normal. Gradenigo also described a fourth group, consisting of one patient with a gap in hearing between 48 and 102 double vibrations. The author used the electrotelephonic acoumeter and the church organ.

Gradenigo concluded from his studies that the lesions occurred in the cochlear nuclei, and he thought it probable that there were at least five bundles of fibers in the cochlear nerve corresponding to the different zones in the tonal scale. He viewed the condition as analogous to the defects in vision in disseminated sclerosis.

TREATMENT

Frey [10] believed that roentgen-ray therapy helps to regulate the endocrine system. Several of his patients have been treated by radiation to the petrous bones, in conjunction with the administration of iodides internally, the use of a staphylococcus vaccine and parenteral injection of albumin.

The roentgen ray is applied to the thyroid and parathyroid glands and to the ears and hypophysis. Some of these patients were treated

34. Gradenigo, Guiseppe: Nineteenth Congress Ital. Soc. Laryngol. and Otol., October, 1922.

for four or five years; in some of these, the otosclerosis improved for a few months, and in others the condition seemed to be arrested.

Delie [11] suggested prophylaxis, as the disease is hereditary, and suggested that children born of otosclerotic parents should be carefully watched by an aurist from early infancy, the hearing measured from time to time and the child's method of living carefully directed. Special care should be given to diet, the use of tobacco should be prohibited, and possibly iodides and thyroid extracts should be given.

Shirmunsky [35] quoted Lucae as having incised the whole drum membrane in forty-seven patients suffering from otosclerosis, in several of whom the hammer and anvil were removed.

In twenty-eight cases, improvement in hearing was noticed, and in twenty-one the defect in the membrane remained permanent. Shirmunsky employed the artificial perforation in many patients with success, eleven of these being observed for a period of at least two years and some as long as ten years. He selected a spot at the umbo of the handle of the hammer where the circular fibers are absent and where the lamina propria shows only radial fibers. The object of the perforation is to allow sound waves to go directly to the labyrinth in cases in which the sound conduction from the membrane to the stapes is obstructed.

His indications for this operation are chiefly: (1) unusual thickening and calcification of the drum membrane; (2) fixation of the hammer and anvil to the walls of the tympanum.

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35. Shirmunsky, M.: Ztschr. f. Hals-, Nasen- u. Ohrenh. **17**:97 (Dec. 18) 1926.

THE USE OF IODIZED OIL IN THE DIAGNOSIS OF NASAL SINUS DISEASE

PART I *

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WITH THE TECHNICAL ASSISTANCE OF MRS. CLARA MACDOUGAL

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The diagnosis of sinusitis by means of the roentgen ray is often uncertain because the shadows cast by pathologic processes can be confused so easily with normal anatomic variations in bony conformation and density. For this reason, it would seem to be of great advantage if the inner surfaces of the lining mucous membranes could be definitely outlined by some opaque substance. Iodized oil 40 per cent has been used for this purpose (Mac Cready [1] and Goodyear [2]), and I think that it offers great possibilities as a diagnostic aid.

Mac Cready and Goodyear used the oil in the maxillary sinus. Both suggest its use in the frontal and sphenoid sinuses, but Goodyear does not think its use practical in the frontal sinus, and he found it necessary to make injections into the sphenoid through the anterior wall. Mac Cready stated that it is necessary to remove a portion of the middle concha in order to introduce the oil into these sinuses.

I have used the oil in both the frontal and the sphenoid sinuses and have found it to be of considerable value. It has not been found necessary to remove any portion of the turbinates nor to puncture the anterior wall of the sphenoids. The present study includes thirty-five cases with an average of two sinuses filled in each.

MAXILLARY SINUS

The technic of introducing the oil into the maxillary sinus is simple. After irrigation with sterile water through an ordinary trochar or needle, from 3 to 5 cc. of oil is injected with a syringe. Theoretically,

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* Read before the St. Louis County Medical Society, Nov. 11, 1927, and before the Minnesota Academy of Ophthalmology and Otolaryngology, Jan. 13, 1928.

When this article was prepared for publication in August, 1927, the article by Robert H. Fraser in the Battle Creek Sanitarium and Hosp. Bull. **22**:3 (July) 1927, had not yet come to my attention.

I have tried to use the method of filling which he suggests both before and since reading his article, but without very satisfying results.

In his article, Dr. Fraser gives an excellent historical review of the entire subject of opaque filling of the sinuses.

1. MacCready, P. B.: Boston M. & S. J. **195**:464, 1926

2. Goodyear, H. M.: Iodized Oil in Diagnoses of Nasal Sinus Conditions. Arch. Otolaryng. **4**:223 (Sept.) 1926.

there is a possibility of fatty embolism if the oil is introduced between the mucous membrane and the bone. This possibility is obviated by flushing some water through the sinus first. If the water cannot be forced through, the oil is not introduced.

The examination is made by fluoroscope and film. The fluoroscopic examination has been found useful. The amount of oil used usually does not fill the cavity unless the mucous membrane is uniformly greatly thickened. Partial filling is advantageous during the examination under the fluoroscope, because the various angles and surfaces can be flooded and studied separately by manipulating the head. If the cavity is completely filled, only the outlines of the largest circumference can be studied satisfactorily, and polypi or localized swellings may be missed.

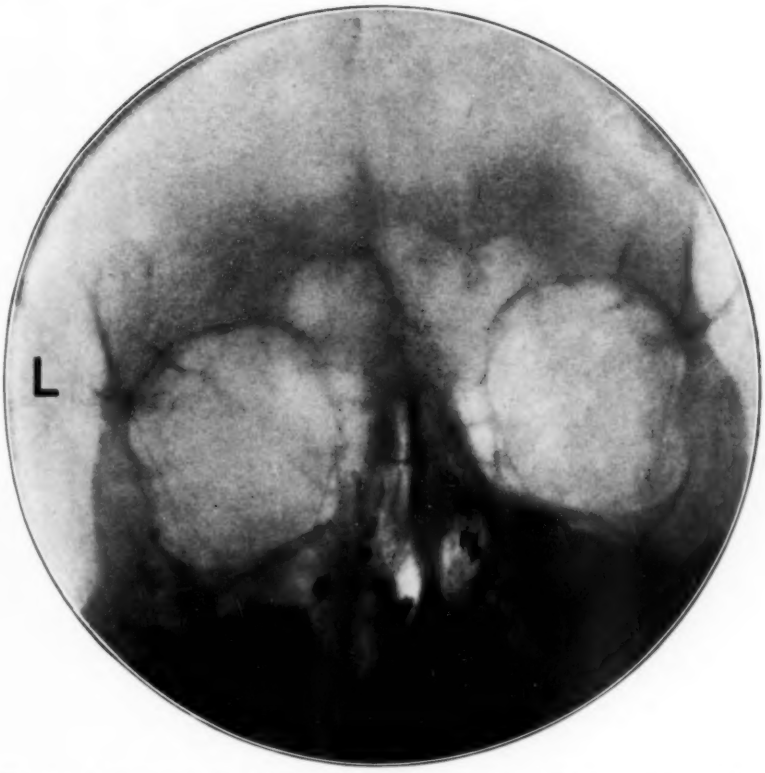

Fig. 1.—Anteroposterior view with the face down. Both maxillary sinuses are completely filled; the left is diseased. The filling on the left is defective; the rounded defects in the lower portion indicate polypoid masses.

Normal Appearance Under the Fluoroscope.—The maxillary sinus is described as having the shape of a pyramid with the base next the

nose and the apex in the zygoma. In a normal cavity, the oil flows about freely. It can clearly be seen to fill successively all parts of the pyramidal cavity close to the bony outline as the head is tipped this way and that. There is a normal filling defect at the infra-orbital

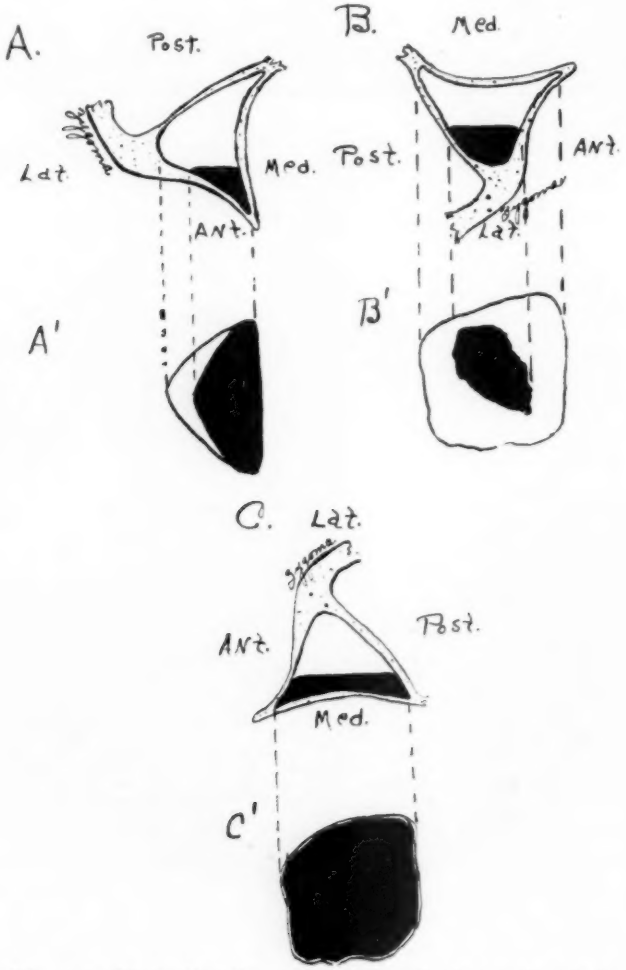

Fig. 2.—Diagrams illustrating the action of the oil when a sinus is insufficiently filled. *A*, *B* and *C* represent horizontal sections through the maxillary sinus in various positions looking caudad. In *A* the face is down next the film. *B* is the profile position with the filled side next the film. *C* is the profile position with the filled side away from the film. *A'* *B'* and *C'* represent the projection of the oil on the film in these various positions.

canal in the roof. The nasal wall or base of the pyramid usually presents a convexity corresponding with the inferior meatus. This may give the appearance of a filling defect when this surface is flooded,

especially if a small amount of oil is used. The bony ridges which so often groin the angles or partial dividing walls which tend to separate the cavity into two chambers may also be seen, but usually all of these can be differentiated easily from pathologic processes in the mucous membranes.

Pathologic Appearance.—When the mucous membrane is uniformly much swollen, as in acute sinusitis, the oil collects in a small pyramidal mass in the center of the sinus with a narrow extension reaching

Fig. 3.—Both maxillary sinuses are partially filled and are normal. The appearance of a filling defect on the right side is due to an insufficient amount of oil to cover the anterior wall when the face is down.

medially and upward toward the osteum. It is stationary as the head is moved about. If the swelling is less and the cavity larger, the surface level of the oil may be seen to change as the head is moved, but the oil does not flow freely into the angles.

In chronic disease a number of different appearances are exhibited, depending on the nature of the pathologic changes in the membrane. The mucous membrane may be uniformly and slightly, moderately or

greatly, thickened. In such cases, the oil fails to reach the bony outlines by the amount of the thickening. The margins of the oil are apt to be somewhat irregular. If there are abscesses within the mucous membrane, or polypi or localized polypoid swellings, they are outlined as filling defects as the oil flows about and over them.

Roentgen-Ray Appearance.—A roentgenogram is sometimes necessary to determine the bony outline definitely. The appearance of the oil on a picture depends on the condition of the mucous membrane

Fig. 4.—Defective filling of the right maxillary sinus in a child. This sinus was irrigated for about two months. At operation, the swollen mucous membrane was found almost filling the sinus.

of the lining, the degree of filling and the position of the head. Sufficient oil must be introduced to cover the anterior wall when the face is down, otherwise false appearances are produced. All of the roentgenograms shown were taken when the patient was lying down.

Normal Appearance.—In most cases, the bony outline can be readily seen. The margins of the oil parallel this at a distance of about 1 mm. (fig. 1). When the oil is insufficient to reach the outline of the greatest

circumference within the cavity, apparent filling defects occur, which are not to be confused with thickening of the lining membrane (fig. 2). When the face is next to the roentgenogram in an anteroposterior picture and the oil is insufficient to cover the anterior wall, an unfilled crescent appears on the lateral side (figs. 2 A, A′ and 3). With the sinus in question next to the film in a lateral view, the oil gathers in the apex of

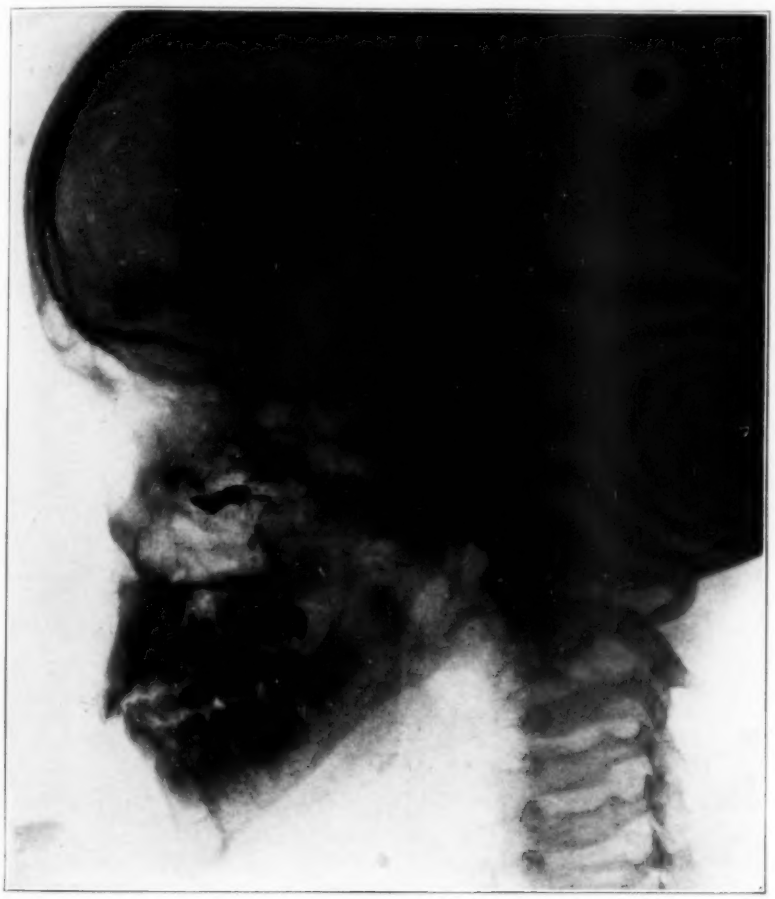

Fig. 5.—Lateral view of diseased right maxillary sinus in a child (see fig. 4).

the pyramid, and the remainder of the sinus projects as an unfilled zone surrounding the oil. This is apt to be widest anteriorly and below (figs. 2 BB′ and 7). If the sinus containing the oil is uppermost (away from the film), the oil covers the nasal wall or base of the pyramid which presents the widest circumference and unfilled zones do not appears (fig. 2 CC′).

Figure 1 illustrates a case of chronic sinusitis on the left side with much uniform thickening of the membrane. The rounded defects in the lower portion of the oil mass indicate rounded, polypoid swellings.

Figures 4 and 5 show anterior and lateral views in a case of chronic sinusitis with much swelling in a child aged 9. Two months of irrigation failed to bring about healing. The foul pus which was obtained at first changed to a more scanty mucopurulent secretion, but did not cease. A number of fillings were made during this time, but the shape and

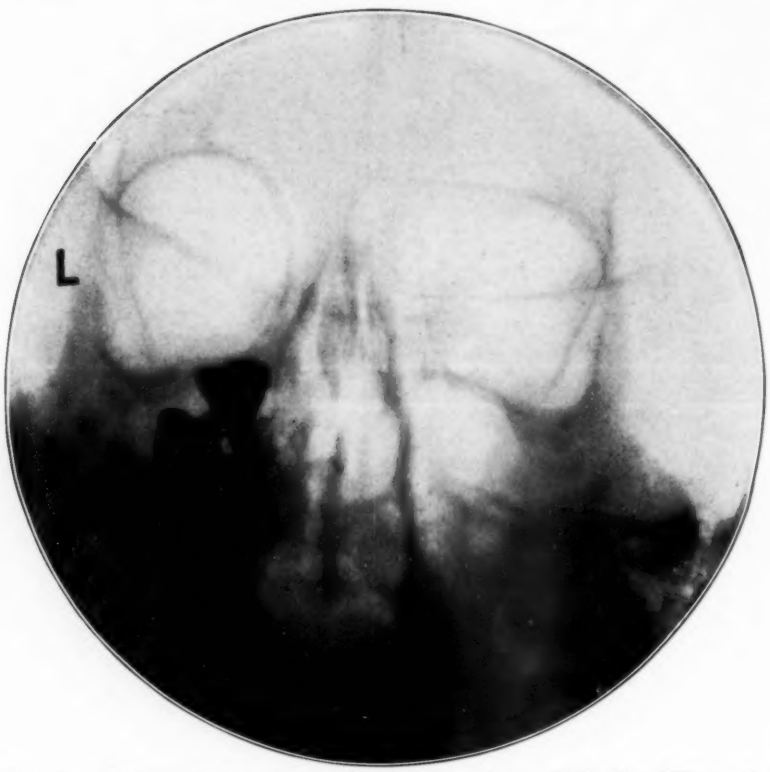

Fig. 6.—Anteroposterior view with the face down. Defective filling of the left maxillary sinus. The oil margins are irregular and a defect is present in the center of the oil mass. Numerous polypi were found at operation (see figs. 7 and 8).

quantity of the retained mass of oil did not change materially. At operation, the mucous membrane was found to be so swollen and edematous as to almost fill the cavity.

Polypi and polypoid swellings in the mucous membrane present an entirely different picture than the uniform swelling just described. Polypi appear as more or less rounded filling defects in certain areas, while the remainder of the cavity may fill close to the bony outline

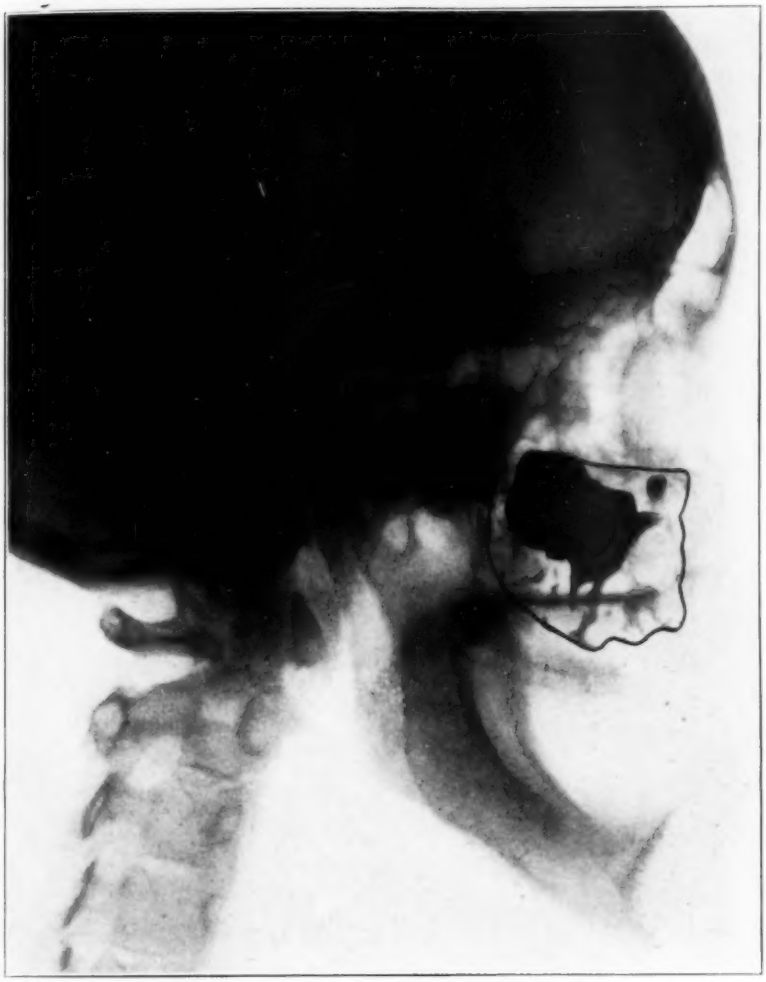

Fig. 7.—Lateral view of the same sinus as shown in figure 6. The left side of the face was next to the film and the oil has collected toward the zygoma. The irregular rivulets in the anterior and inferior portions outline the polypi in these areas (fig. 8).

Fig. 8.—Polypi removed from the sinus shown in figures 6 and 7.

(fig. 6). The margins of the oil are irregular both in outline and density, and a filling defect occurs in the center of the oil mass, yet the oil follows the bony outline closely at the roof. At operation, one polyp was found suspended from the roof in the anterior part of the cavity, and a number of others occupied the anterior half of the floor and lateral wall. The lining membrane of the roof and the posterior wall was smooth and thin. The filling defect in the center

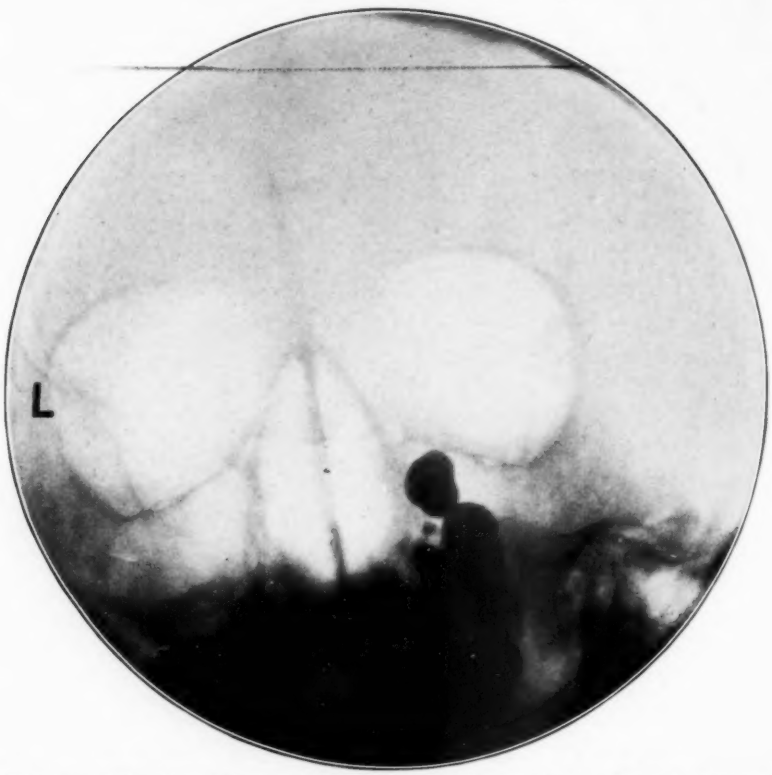

Fig. 9.—Defective filling of the right maxillary sinus. The oil appears in irregular rounded masses which fail to reach the bony outline at many points. At operation this sinus was found to contain many polypi within the sinus and what appeared to be the attachment of the lateral wall of the pedicle of a nasopharyngeal polyp (see figs. 10 and 11).

of the oil mass was apparently caused by the suspended polyp and the other irregularities by those lying on the floor and lateral wall.

Figure 7 shows the same case in lateral view with the filled maxillary sinus next the film. The oil is collected in the apex of the pyramid. Rivulets can be seen anteriorly and inferiorly to the main mass of oil outlining the polypi in that area. Figure 8 is a photograph of the polypi removed.

Fig. 10.—Lateral view of the same sinus shown in figure 9. Many polypi were found at operation (see fig. 11).

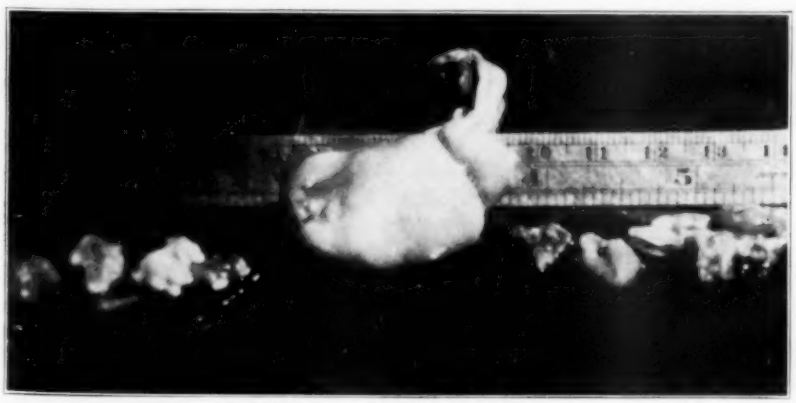

Fig. 11.—Polypi removed from the sinus illustrated in figures 9 and 10.

This patient's chief complaint was a continuous cough. She did not have any nasal symptoms, and pus could not be washed from her sinuses. After the operation, her cough disappeared.

Figures 9 and 10 illustrate a case in which there was a large nasopharyngeal polyp on the right which arose from the maxillary sinus. The sinus contained a number of other polypi removed at operation (fig. 11).

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THE SENSORY FIELD OF THE FACIAL NERVE

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The interesting cases which I shall report are offered as further clinical support of J. Ramsay Hunt's work in the sensory field of the facial nerve. The geniculate ganglion, located at the knee of the facial nerve, contains unipolar cells the axones of which divide in the shape of a *T* into two processes, one passing centrally through the intermediary nerve of Wrisberg to the medulla, the other passing peripherally as the chorda tympani and greater superficial petrosal nerves, the latter forming an important root for the nasal ganglion. In Contributions to the Study of the Sphenopalatine Ganglion I demonstrated the importance of the greater superficial petrosal nerve in the causation of headache and neuralgia of the back half of the head and neck. This paper presents part of my study on the distribution of the sensory fibers of the facial nerve. The cases demonstrate especially the intra-oral supply. Hunt, in his studies, has tried to trace the sensory elements of the facial nerve through a study of the manifestations of herpes zoster from the geniculate ganglion of the facial nerve. Such a method is necessarily incomplete because herpes zoster is only one manifestation of nerve disturbance, and the clinical material is extremely limited. I recognized that the greater superficial petrosal nerve which represents a sensory root from the facial nerve to the nasal ganglion is responsible for a large part of the so-called Sluder syndrome. By cocainizing the nasal ganglion one can, to a large extent, anesthetize the sensory system of the facial nerve, and to such a degree as to control the pain in herpes zoster oticus. Therefore, this method is valuable for the study of the sensory distribution of the facial nerve. In this paper I am tracing chiefly the intra-oral distribution.

REPORT OF CASES

CASE 1.—*History.*—Mrs. A. S., aged 56, came to my office complaining of difficulty in hearing on the right side, tinnitis and vertigo. Her complaint dated back two and a half years. At that time she began to suffer from a burning sensation at the tip of the tongue on the right side and from a bitter taste along the side of the mouth. This was associated with a feeling of fulness and scratchiness in the throat and an itching of the roof of the mouth and of the right side of the face. She also complained of pain in the back of the head radiating to the right shoulder. Her right eye felt as though it were in a frame, with a burning sensation around it. At the time of the examination she complained of a deficient sense of taste on the right side. The right side of the face and lips felt somewhat numb. Aside from symptoms in the ear the case impressed me as having some

of the elements of neuralgia of the nasal ganglion, of the facial nerve type, which I described previously.[1]

Examination.—The following observations were recorded: slight ptosis of the right eyelid; diminished corneal reflex; a mild atrophic rhinitis; a spontaneous vestibular nystagmus with the rapid component to the right, spontaneous past pointing to the right and slight tendency to falling, but not distinctly to either side. In the Weber test the patient could not lateralize accurately to either side.

The Rinne reaction was infinitely negative on the right and positive on the left.

The Schwabach reaction was markedly diminished on the right and slightly diminished on the left. This hearing by bone conduction was probably due to the hearing in the left ear. The C 4 tuning fork was heard on the right only when struck forcibly; on the left the sound of the C 4 fork was only slightly diminished. The C 1 fork was not heard on the right but was heard normally on the left.

Irrigation of the right ear with cold water did not result in any change in the spontaneous nystagmus. Irrigation of the right ear with warm water did not result in any change in the nystagmus. Rotation to the right caused active nystagmus to the left of twenty seconds' duration; rotation to the left caused a slight increase in the spontaneous nystagmus already present.

The analysis of this case is extremely interesting. From the history, excluding the symptoms in the ear, the case appeared almost typical of a form of neuralgia of the nasal ganglion which I ascribed to the sensory elements of the facial nerve. At the same time, there were distinct signs of a lesion of the auditory nerve which affected both the vestibular and the cochlear portions. Such a disturbance would most probably be produced by a mass compressing the region of the internal auditory meatus or cerebellopontile angle. The questions that arose were what symptomatology other than motor disturbances could be looked for from the facial nerve in tumors of the acoustic nerve, also how many of the sensory symptoms usually accredited to the trigeminal nerve in these cases really are due to the sensory root of the facial nerve which is so intimately related to the acoustic nerve and cerebellopontile angle. By my work on the nasal ganglion, I was able to demonstrate that the sensory elements of the greater superficial petrosal branch of the facial nerve gave rise to a large part of the symptoms of the so-called "Sluder's syndrome." The typical pains in the ear, mastoid, occipital, cervical and shoulder regions could really be traced to the facial nerve and its branches.

A closer study of the facial nerve helps in the analysis. The facial nerve, as before stated, consists of a motor and a sensory part, the latter being frequently described under the name "nervus intermedius." The motor portion supplies somatic fibers to the muscles of the face, scalp and auricle, to the buccinator, the platysma, the stapedius and the

1. Ruskin, S. L.: Laryngscope **35**:87 (Feb.) 1925.

stylohyoideus and to the posterior belly of the digastrius; it also contains some autonomic fibers. The sensory root of the facial nerve, with which I am most concerned, arises from the geniculate ganglion situated in the facial angle at the upper medial wall of the tympanic cavity. The cells of this ganglion are, as before stated, unipolar, and the single process divides in a *T*-shaped manner into central and peripheral branches. The central branches leave the trunk of the facial nerve in the internal acoustic meatus and form the sensory root; the peripheral branches are continued into the chorda tympani and the greater superficial petrosal nerve which runs to the nasal ganglion. The branches of communication of the facial nerve may be arranged as follows: at 1, the internal acoustic meatus; 2, the genticulate ganglion; 3, the facial canal; 4, its exit from the stylomastoid foramen; 5, behind the ear; 6, on the face; 7, in the neck. The communications are made with: 1, the acoustic nerve; 2, the sphenopalatine (nasal) ganglion by the greater superficial petrosal nerve; 3, the otic ganglion by a branch which joins the lesser superficial petrosal nerve; 4, the sympathetic nerve on the middle meningeal artery; 5, the auricular branch of the vagus; 6, the glossopharyngeal nerve; 7, the vagus nerve; 8, the greater auricular nerve; 9, the auriculotemporal nerve; 10, the lesser occipital; 11, the trigeminal nerve; 12, the cutaneous cervical nerve. Only in the light of such wide connections does one begin to see how an irritation of the sensory roots of the facial nerves can produce disturbances ranging from neuralgia of the face to that of the neck and shoulder. Although one generally considers the branches of the facial as purely motor, nevertheless, the intimate association with the sensory portion makes it probable that the branches of the facial nerve are mixed, since clinically one finds pains that are distributed exactly along the previously described connections of the facial nerve and are relieved by anesthetizing of the greater superficial petrosal branch of the facial nerve at the nasal ganglion. This must be considered as more than a coincident. This impression is borne out by other clinical observations which I have made of pains distributed in typical headaches of the posterior half, associated with acute facial neuritis with facial paralysis.

In addition, the sensory root of the facial nerve possesses taste fibers which reach the nasal ganglion by way of the greater superficial petrosal nerve. From the nasal ganglion these fibers are distributed to the mouth and tongue. L. R. Mueller has also described vasomotor fibers (cranial autonomic) in the nervus intermedius, some of which are distinctly connected with the secretion of tears.

The patient under consideration showed a disturbance of the fibers of taste in that she complained of a bitter sensation along the side of

the mouth, burning at the tip of the tongue and loss of the sense of taste. Her neuralgia was along the course of the facial communications. With this disturbance she experienced a loss of function of the vestibular and cochlear nerves. As stated before, a single lesion in the region of the internal auditory meatus, where the auditory and facial nerves enter the petrous bone, would cause both of these syndromes simultaneously. Usually one looks for disturbances of the facial nerve in the form of motor paralysis. It would be well to look for the sensory lesions of the facial nerve which appear under the guise of neuralgia of the sphenopalatine ganglion. The sensory disturbances, as in this case, may precede the motor disturbances, and they should be an aid in the localization of lesions in the cerebellopontile angle and tumors of the acoustic nerve. The growth in case 1 proved later to be a tumor of the cerebellopontile angle; it was partially removed at operation.

The second case revealed the intra-oral distribution of the facial nerve following an acute facial neuritis, with paralysis and with incomplete recovery.

CASE 2.—Mrs. S. M. complained for three months of a sweet taste on the same side of the mouth as the paralysis, associated with burning and sticking pains at the tip of the tongue and noises in the ear on the same side. The disturbance of taste was so great as to overshadow her other complaints. She suffered from severe attacks of vertigo and right-sided hemicrania which extended into her neck and shoulder. In addition, she had rhinorrhea and sneezing. Three years before, following a severe attack of rhinorrhea, she developed facial paralysis on the right which lasted for two years. At the time of examination it was present to a small extent. The sticky pains in the tongue were traced back to the onset of paralysis. Examination revealed a chronic, bilateral ethmoiditis and chronic tonsillitis. Anesthetization of the terminal endings of the greater superficial petrosal branch of the facial nerve at the nasal ganglion immediately stopped the sweet taste in the mouth and the burning of the tongue, as well as the hemicrania and vertigo.

This case was one of inflammatory involvement of the facial nerve in both its sensory and its motor portions, the sensory manifestations of which could be controlled through the greater superficial petrosal nerve.

The third case demonstrates the same symptomatology as that in case 2; disturbance of taste and pain at the tip of the tongue, associated with profuse salivation and severe vertigo, probably due to a peripheral lesion which caught the fibers of the greater superficial petrosal nerve at the nasal ganglion, with some irritation reaching back to the communication with the eighth nerve and centrally to the nucleus salivatorius.

CASE 3.—*History.*—Two years before admission J. K., a silk merchant, aged 63, had noticed a salty taste on the left side of the mouth, which changed in a few months to a bitter taste of which he still complained at the time of examination. He suffered also from a burning pain along the left side of the tongue, most severe at the tip. From the time of onset, he had had profuse salivation on the left side and severe attacks of dizziness every two or three weeks which necessitated his going to bed from one to three days. The attacks of vertigo were frequently associated with nausea and vomiting. The character of the vertigo was described as rotary, and at times his sensation would be one of falling away from the objects he saw. In cold weather, he suffered from rhinorrhea and slight pain in the left maxillary region.

Examination and Course.—Nasal examination revealed a bilateral ethmoiditis; otherwise, the observations were negative. The patient had had an ethmoidectomy on the left side one year prior to his coming to see me. During the two years of his complaint, the patient had undergone almost every conceivable form of treatment without benefit. Because of his age, the vertigo had been attributed to arteriosclerosis and his taste sensation to gastric disturbance. Anesthetization of the nasal ganglion gave him immediate relief. After the injection of alcohol by the route which I have recorded for injection in the sphenopalatine ganglion, the patient was relieved of all symptoms but the profuse salivation.

The fourth case is extremely interesting in that it represents a case of herpes zoster auris in which the lobule of the auricle, the fold behind the auricle and the skin along the sternocleidomastoid were involved. The distribution would correspond with the connections of the posterior auricular branch of the facial nerve to the auricular branch of the vagus nerve. An interesting feature of the case was the immediate control of the pains due to herpes zoster by cocainization of the greater superficial petrosal branch of the facial nerve at the nasal ganglion.

CASE 4.—Miss L., aged 60, for three weeks prior to the eruption had felt a stiffness of the muscles of the left side of the neck radiating to the left shoulder. One week before coming to my office she suddenly developed sharp shooting pains in the left ear and down the left side of the neck, simultaneously with a vesicular eruption on the lobule of the ear, behind the ear and along the sternocleidomastoid. The pains were sharp and stabbing, and they recurred every few minutes. The eruption which was at first vesicular became covered with a purulent crust which had a dark necrotic center. The area of the eruption was both painful and itchy and it was most acute on the lobule of the ear. The first application to the nasal ganglion gave immediate relief which lasted for five hours. For the next few days the patient received treatments twice a day with complete relief from pain.

I previously reported in the *Laryngoscope,* a case of herpes zoster auris in which the patient was relieved by treatment of the nasal ganglion, but in that case the eruption was limited to the canal and drum. In the present case, however, I was able to obtain a photograph of the eruption (figs. 1 and 2).

CASE 5.—Miss A. G., aged 15, seen by me at the New York Post Graduate Hospital, had three years previously, suddenly developed a palsy on the left side

of the face, apparently peripheral, associated with acute pains over the left mastoid, more especially in the fold between the auricle and the mastoid. From the period of onset of the paralysis to the present, she had undergone a wide range of symptoms, causing a fluctuation of diagnoses from multiple sclerosis and tumor of the brain to astasia abasia and hysteria. Despite the fluctuation of other symptoms, however, the facial palsy and mastoid pain remained constant. The pain was in the region described by Hunt as "the distribution of the geniculate ganglion," as evidenced in cases of herpes zoster originating in the geniculate ganglion. My diagnosis in this case was complete facial neuritis involving both the motor element and the sensory element through the geniculate ganglion. Sluder described mastoidalgia relieved by treatment of the nasal ganglion, but

Fig. 1 (case 3).—Manifestation of herpes zoster auris indicated by arrows.

did not offer an explanation for the mechanism. Following Sluder's suggestion, one of the men in the clinic repeatedly injected alcohol into the nasal ganglion without relieving the patient.

When one considers, however, that the mastoidalgia is due to involvement of the sensory elements of the facial nerve, it is readily seen that the lesion is proximal to the nasal ganglion and that injection of the nasal ganglion in this instance is useless. Cocainization of the nasal ganglion, however, does not relieve the mastoidalgia, because the narcotizing effect is carried by the terminal ends of the greater superficial petrosal nerve from the nasal ganglion to the geniculate ganglion, thus

relieving the pain. Unfortunately, in this case, the repeated injections of alcohol removed the possibility of affecting the greater superficial petrosal nerve through the nasal ganglion, and local cocainization had but little effect.

The vasomotor fibers carried by the nervus intermedius deserve great consideration. In this paper I want to call attention particularly to the lacrimal fibers, some of which are autonomic in character and travel by way of the nervus intermedius and greater superficial petrosal

Fig. 2 (case 3).—Manifestation of herpes zoster auris indicated by arrows.

nerve to the nasal ganglion, and from there to the lacrimal gland. These fibers are cranial autonomic in character. The lacrimal gland, however, also receives sympathetic fibers from the cervical sympathetic ganglion. In many of the cases in which I made injections into the nasal ganglion, I observed a diminished secretion of tears on the side in which the injection was performed. In addition I also observed an excessive secretion of tears associated with other manifestations of neuralgia of the nasal ganglion. It has been known for a long time

that there may be a diminution in the secretion of tears associated with facial palsy. I was able, however, to prove this academic observation clinically by injection of the nasal ganglion of a patient who had had an unsuccessful operation on the lacrimal sac with complete occlusion of the lacrimal canal and resultant profuse epiphora. Following injection of the nasal ganglion, the epiphora diminished markedly and the patient had considerable relief. The excessive secretion of tears diminished only partially, however, because the lacrimal gland has a double innnervation, and the injection removes only part of the autonomic supply. This observation can have a wide range of clinical usefulness.

SUMMARY

In tumors of the cerebellopontile angle or acusticus tumors, involvement of the sensory root of the facial nerve may be an early symptom, simulating neuralgia of the nasal ganglion and giving rise to a burning sensation at the tip of the tongue, disturbances of taste along the side of the mouth, a fulness and scratchy feeling in the throat and itching of the roof of the mouth. The symptomatology may occur with other lesions affecting those fibers of the facial nerve that pass through the greater superficial petrosal nerve. Also, the pains in the posterior half in Sluder's syndrome are probably due to the sensory elements in the facial nerve. One may consider the symptomatology described as part of the intra-oral representation of the facial nerve. The cases also give clinical proof of the academic statement that the greater superficial petrosal nerve carries taste fibers by way of the nasal ganglion, and that lacrimal fibers (cranial autonomic) are carried by way of the greater superficial petrosal nerve and the nasal ganglion.

Clinical Notes

THE PHENOMENON OF SUBJECTIVE SOUND PERCEPTION FOR WORDS AND SENTENCES: REPORT OF A CASE

ROBERT G. REAVES, M.D., KNOXVILLE, TENN.

REPORT OF CASE

A man, aged 68, complained of symptoms of nasal catarrh, defective hearing and the subjective hearing of sounds or words when reading or thinking. There was nothing significant in the family history. The patient had the usual diseases of childhood — measles, mumps and whooping cough; he did not use tobacco or alcohol and had not had venereal disease. Since adolescence, he had enjoyed good health, except for the nasal and aural symptoms. The nasal symptoms dated back for twenty-five years. In 1916, he had symptoms of a bilateral otitis media. The nasal symptoms were associated with the development of nasal polypi. He had had tinnitus for the past twenty years, which he described as cricket-like sounds and crackling noises, especially on the left. He stated that the defect in the right ear developed during a cold in the head in 1916.

In the fall of 1917, the patient began hearing words in the left ear when reading or thinking. The words were described as being as distinct as those heard over a telephone. At first they were indistinct and not always present but were more noticeable during colds. For the past year and a half, they had been more distinct and fairly constant; they were usually heard in the left ear and occasionally switched to the right. If the patient thought of a phrase, for instance, "six o'clock" the words might repeat themselves. If the patient was spoken to, the words would repeat themselves if a strong impression was made on his mind, that is, after he thought over what had been said to him. He had, in addition, tinnitus like escaping steam varying in intensity in waves of about one and one-half pulse beats. This symptom was present in both ears. He also had a low, humming, pulsating tinnitus in the left ear. He had acquired the habit of frequently inflating the middle ear by Valsalva's experiment to improve the hearing. Paracusis willisiana was formerly present. This symptom had disappeared.

On examination, the tonsils were somewhat injected; the septum was deflected moderately to the right; nasal polypi were present in the middle meatus, right and left, a mucous polyp was in the superior meatus on the right, and polypoid degeneration of the ethmoid was found.

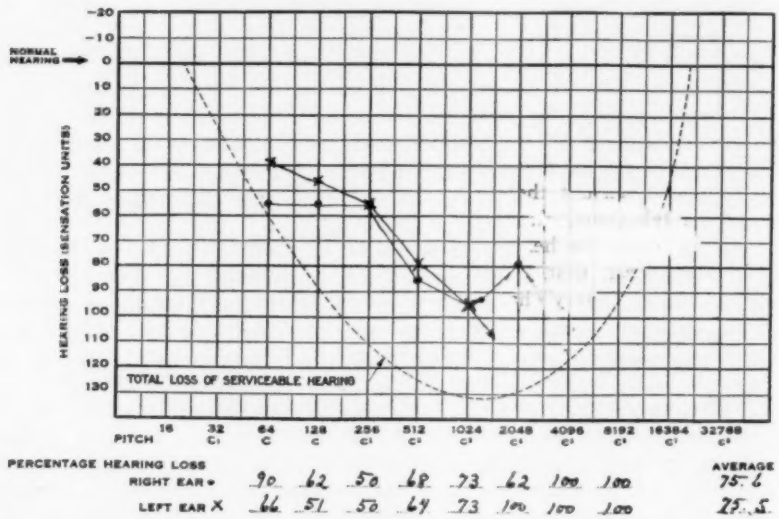
The membrane of the right drum was retracted and atrophic; the tube seemed tight. The membrane of the left drum was retracted and lusterless; the tube was more or less contracted. Conversation could be heard 1 inch from the ear on both right and left. The lower forks were heard between 128 and 512 double vibrations in the right as well as in the left. The Galton whistle, was heard at 10 in both ears. The Rinne test, the 128 and 512 double vibration forks being used, was negative.

In 1922, operations were performed on both sides of the nose for the removal of polypi and drainage of the maxillary, ethmoid and sphenoid sinuses.

The neurologic examination made in April, 1926, showed nothing of significance. Caloric reactions in both the right and the left ears gave normal responses. The urine and blood were practically normal.

In February, 1927, the patient's general health was good; he felt well, though he still had some annoyance from postnatal catarrh. The phenomenon of sounds (noises) repeating themselves was more marked in the left but switched from one ear to the other. The repeating noises were more pronounced in the ear in which the subjective noises were the greater. Both drums were flabby and atrophic. Both tubes were patulous. The frontal and maxillary sinuses were clear. The region of the ethmoid showed little tendency for the return of the polypoid degeneration: The audiographic record for each ear is shown in the accompanying illustration.

The case has been of interest to me because of its peculiar phenomenon of subjective hearing of words and sentences when reading or during concentra-



Audiographic record of patient.

tion of attention. Here is a man who can hear what he sees, hear what he thinks and hear short sentences repeated when he is spoken to. The question arises, How is the auditory center stimulated? I have two letters from outstanding psychologists on the subject which I will quote.

The first is from Dr. H. L. Hollingworth, of Columbia University: "Traditional theories assume that the auditory center may be stimulated indirectly through the visual center, and that this is the basis of "auditory imagery" as it occurs when aroused by words and other visual cues. Most people, when they read words or hear words, also pronounce them, perhaps subvocally. Many people mistake this faint articulation of words for the sound of them, since whenever they speak the words the sound is an invariable accompaniment. This is especially likely to be the case with relatively uneducated people who have not acquired facility in "silent reading." Is it possible that your patient thus faintly articulates the words he sees or hears and mistakes this articulation for another hearing of them?"

The second is from Dr. R. M. Ogden of Cornell University, who says: "I can make but two rather general suggestions. First, I do not believe sense perception and imagination are so clearly distinguishable as is sometimes supposed. When I read I also hear the words I see. If I were deaf, the absence of the objective sounds might lend actuality to my imagery sounds for lack of contact with objective sounds. Secondly, there is a type of imagery which is characterized by its actuality. This type has been investigated in recent years by a German psychologist, E. R. Jaensch, whose results are published in the *Zeitschrift fur Psychologie.* Jaensch finds that many persons possess imagery so vivid that it is like perception. He calls this type "Eidetic." His experiments with young children seem to show that every one passes through a stage of development in which a distinction is not made between sensation and imagery. Even as they grow older and are required to make these distinctions, some persons retain the capacity to imagine some things with perceptal objectively. Your case may be one of this sort." He further writes, "I find nothing impossible in supposing that audition may result from the association of the visual and auditory centers; but this, I think, need not involve an efferent nervous stimulation of the ear before the audition can be achieved."

Here is a patient whose auditory center can be stimulated through vision and by volition, and also through the auditory nerve that there may be an "echo-acousia." He describe[illegible]e audition as coming from one or the other ear as if over a [illegible]t switches from one ear to the other and is heard in the ear [illegible]ad noises (subjective noises) are louder. The case is of much intere[illegible] from the fact that the psychologic phenomenon of "visual auditory ima[illegible] as been brought about, or accentuated, by loss of hearing, chiefly nervous in character, and by the fact that it is localized in either ear. The auditory center is stimulated, not through the auditory nerve, yet the audition is localized to one ear. The patient does not speak the words as he reads and even if he did, his hearing is so poor he would have to make distinct audible sounds in order to hear them himself. He does not do this. Secondly, he has "volitional auditory imagery;" that is, he can think a short sentence and hear it, localizing the sounds to one ear. Thirdly, he has echo-acousia. In case of audition from stimulation of the auditory nerve, the sounds may be repeated more than once, and therefore the condition is better termed echo-acousia, as the phenomenon cannot be explained by the assertion that the sensation from one ear reaches the auditory center later than from the other (diplacusis echotica). This echo-acousia should perhaps be properly placed under "volitional auditory imagery," as the patient hears repetition of words when he is spoken to only when they have made a strong impression on his mind.

The psychologic phenomena are so outstanding in this case and at the same time point to a pathologic condition of the ears that otologists should be on guard in trying to explain the modus operandi of some of the cases of diplacusis echotica with which they come in contact.

COMMENT

At my request, Dr. Charles W. Richardson of Washington examined the patient and gave me the following statement: "Dr. Reaves' patient, W. T. M., was presented to me, May 17, 1927. I had carefully gone over the case as presented in the history by Dr. Reaves and a careful analysis of all of the

statements made as to the examinations by Dr. Reaves, all of which seemed to be in precise order. I had come to the conclusion that this case was of a peculiar psychic condition indefinitely connected with the otologic manifestations; by indefinite, I mean that may have arisen out of his otologic condition but not due to it. Such a condition arises, I believe, from the fact that the patient's relation with the outside world is reduced because of the impairment or loss of his hearing, and this gives rise to the increasing of his imaginative power.

So far as the physical manifestations are concerned, I did not have the time at my disposal to go over them or did I think it necessary to do so. I suggested to Dr. Reaves that he get a psychiatrist to go over the case with him, and at my suggestion he selected Dr. Daniel Stuart who reported the examination of the patient.

I do not mean to suggest that this man has any disturbance of the cerebral centers which would indicate that he has not complete control of his mentality. I believe that he allows sounds or ideas to repeat themselves and through the excessive activity of his imagination hears things which do not actually exist."

Dr. Stuart's report follows:

Neurologic Status.—The pupils were regular and equal and responded promptly to direct and consensual light stimulation, and in accommodation. The margins of the disks were clear and the cups distinct; the retinal arteries were white lined, but were not tortuous and did not indent the veins. The retinas were normal. Except for bilateral deafness of the eighth nerve, all other cranial nerves functioned normally. Station and gait, muscle status, deep and superficial reflexes, coordination and speech did not show any disturbance. The sensory status was not examined.

Mental Status.—The intelligence-level was high, and the patient's emotional reactions quite normal. No psychotic symptoms of any kind were elicited, nor could he be classed as a neurotic.

Impression.—The condition is not to be accounted for as evidence of organic nervous disease, nor on a psychotic or neurotic basis. Without going into a long discussion on the relationship of the visual and sound-perception centers, I may say that the matter is entirely conjectural. My own explanation of the case would be as follows: Some people, perhaps all, can produce on themselves the impression of audible sound, through a process that I can only call "silent whispering." The mechanism of this consists of movements of the tongue against the teeth and palate during either inhalation or exhalation, with the mouth closed. This I know to be possible from my personal experience. I believe that your patient has formed this habit unconsciously and my belief is borne out by two facts: First, he states that he only "hears" when concentrating on his reading or his thoughts; and that he can "read or think mechanically" without hearing the words at all. Second, when I had him read a paper to himself (not aloud) I noticed small movements of his throat, such as would be caused by the activity of the speech-mechanism I have described. If I am correct, it might be possible to call his attention to his habit and thereby end it and prove my hypothesis."

I also append a short statement made by Dr. George E. Shambaugh of Chicago: "This patient presented by Dr. Reaves has chiefly a psychologic interest. Although the patient has a defect in hearing, the symptoms have to do with subjective hearing. As a matter of fact, while subjective hearing

is the most common of ear symptoms, the subjective hearing of words or sentences is a most unusual phenomenon. The mentally deranged sometimes hear things said about them that result from their mental disturbances. The phenomenon exhibited by this individual is not, I feel, the result of mental derangement any more than it is the result of disease of the ear. The explanation is a problem for the psychologist."

GRADENIGO'S SYNDROME

AN INTERESTING CASE

S. B. Forbes, M.D., Tampa, Fla.

History.—N. V., aged 9, referred to me by Dr. Rafael Ortega, had been ill 100 days when I first saw him. His chief complaint was a severe pain over the left side of the head and double vision. The mother reported a daily temperature running up to 100.5 F. every afternoon and progressive weakness.

The patient gave a history of an acute otitis in the left ear with spontaneous rupture of the drum two years prior to this attack. The ear drained for one month; otherwise the past history was essentially negative.

The present attack developed with a severe cold which became progressively worse. The child became unconscious on the tenth day of the disease, and the temperature went up to 105 F. The child started to show improvement on the twentieth day, and five days later he began to complain of a severe pain over the left side of the head and the face. At this time the left eye started to turn in toward the nose. After that the patient's condition remained about the same. The left side of the face, according to the child, had become somewhat deadened.

Examination.—Examination showed a rather emaciated, pale and fretful child with a temperature of 100.4 F. Examination of the eye showed a definite paralysis of the external rectus on the left side. Any effort to rotate the eyes to the left caused pain over the affected muscle, and there was a definite tenderness over this portion of the globe. The pupils were equal and reacted consensually to light. The eyegrounds were negative, and the media were clear. The results of the examination of the nose and throat were essentially negative. Examination of the ears showed the right one to be normal. A scar was found on the anterio-inferior quadrant of the drum of the left ear, otherwise the results of the examination were negative. There was no pain over the region of the mastoid on either side.

There was a definite loss of sensation in the left side of the face as shown by thermal and tactile tests. The general physical condition was essentially normal except for marked emaciation. The blood picture did not aid in the diagnosis. The roentgen-ray examination showed that there was mastoiditis on the left side, but did not show evidence of a breaking down of the walls of the cells. Dr. Bundy Allen made the roentgen-ray examination.

Operation.—Following the localization of the lesion at the pyramidal apex and the positive roentgenologic observations, a mastoidectomy was performed on the left side. The general body of the mastoid was filled with granulation tissue, except at the tip. The middle ear was sealed off from the mastoid by granulation tissue in the aditus. The culture showed long chain streptococci.

The child reacted satisfactorily from the operation, and the temperature was normal on the fifth day. The ocular paralysis could hardly be recognized on the tenth day. On the twenty-eighth day, there was still four degrees of error. The muscle balance was absolutely normal on the thirty-fifth day. A most interesting point to me was the fact that the patient did not complain of any pain after the operation. Normal sensation returned to the left side of the face in about three weeks.

SUMMARY

In summarizing this case there are several interesting points:

1. History of otitis media with recovery two years prior to attack.

2. No history of acute attacks of the ear with this illness, but with positive roentgenologic observations.

3. Definite pachymeningitis early in course of illness with recovery from this, but followed by continued temperature, abducens paralysis, gasserian ganglion and temporoparietal pain.

I think that the child had an acute mastoiditis early in the disease, probably of metastatic origin, which did not cause any trouble in the middle ear owing to the aditus being sealed off in previous attack of the ear.

It was indeed unfortunate that information could not be obtained from the physician who had charge of the case in its early stages.

409 Citizens Bank Building.

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

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TONSILS AND ADENOIDS

FRENCH K. HANSEL, M.D.
ST. LOUIS

A review of the bibliographic material relating to tonsils and adenoids which has appeared during the year of 1927 shows not only a continued but an increasing interest in almost all phases of the subject. Particular attention has been directed to pathology, physiology and complications.

Viggo Schmidt continues his studies on the physiology of the tonsils. A most comprehensive work on this phase of the subject was done by Suchanek and Pichler. Most interesting articles on the relation of abscess of the lung to tonsillectomy have been written by Smith, Ochsner and Nesbit.

The number of articles on the general consideration of the subject is small. Most observers direct their studies along certain specific lines. Tucker's article on "Tonsil Infection with Report of Cases" deals chiefly with clinical observations. He had a large group of cases and has comprehensively outlined the indications for operation, preoperative preparation, technic of operation, contraindications, postoperative treatment, postoperative complications and end-results. Roberts' article is a general consideration of the tonsil problem, particularly from the standpoint of anatomy, physiology and focal infection. Bowser outlines the indications for tonsillectomy, and Hamburger gives his experience in diseases of the tonsils in children.

Several noteworthy observations on the relation of the tonsils to diseases of the kidney have appeared. Randolph reports two cases of nephritis in which the patients were apparently cured by tonsillectomy. Jones reports thirteen cases of albuminuria in which the infection cleared up after tonsillectomy. In this article, he states that routine tests disclose the presence of albuminuria or other evidences of nephritis in the majority of cases of acute tonsillitis or other tonsillar infections. Zigler reports a case of pyelitis in which the condition cleared up after tonsillectomy.

Braasch and Cathcart, writing on the subject of "Clinical Data and Prognosis in Cases of Chronic Pyelonephritis," state that the tonsils should be examined in each case, and the probability of such foci being closely related to the chronic renal infection is evidenced by the acute

exacerbation of symptoms frequently observed immediately following the removal of infected teeth and tonsils. Subsequent improvement follows.

The rôle of Waldeyer's ring in the etiology of pulmonary tuberculosis is freely discussed by Maffeo. Stout reports his observations on the nose and throat of a large series of patients with bronchial asthma. His remarks on the tonsils are as follows:

> It would seem that any chronic diseased condition of the body would aggravate the attacks of bronchial asthma, but curiously enough we have not found the beneficial results from the removal of diseased tonsils that might naturally be expected. About 60 per cent of the patients had diseased tonsils at the time of examination. We were able to follow up 77 per cent of these. In 12 per cent there was no improvement; in 23 per cent slight improvement; in 45 per cent moderate improvement and in 20 per cent marked improvement.
>
> Of the 35 per cent who had had tonsils removed, we were able to follow up 80 per cent; in 12 per cent there was no improvement; in 22 per cent slight improvement; in 34 per cent moderate improvement and in 32 per cent marked improvement. In the final analysis, the difference in the results is not startling, but we think it is somewhat in favor of the removal of diseased tonsils.

The relationship of diseased tonsils to goiter has been investigated by Bram, who based his observations on a series of 9,864 cases. He concludes that despite disappointments as to results, diseased tonsils should be removed in all cases of goiter. Care must be exercised in toxic adenoma and especially in exophthalmic goiter that tonsillectomy be performed at a time when the resultant reaction would appear to be negligible.

Two hundred consecutive cases of infectious arthritis were studied by Cecil and Archer as to their etiology. The tonsils and teeth were the most common foci of infection. In young people, infected tonsils are responsible for a high percentage of the cases. In older patients, infected teeth are more apt to be the etiologic factor.

The effects of tonsillectomy on acute attacks and recurrence of rheumatic fever have been noted by Robey and Freedman, who state that there is a prompt subsidence of fever and joint symptoms. The operation did not prove to be disastrous even at the height of the febrile attack.

Kaiser continues his most interesting studies on large groups of children. In his article on "Incidence of Rheumatism, Chorea and Heart Disease in Tonsillectomized Children," he draws the following conclusions:

> 1. A survey was made of 48,000 school children, in 20,000 of whom the tonsils had been removed, and 28,000 of whom they had not been removed.
>
> 2. The history pertaining to rheumatic fever, chorea, scarlet fever and heart disease has been obtained, and 1,200 showing signs of rheumatic fever, chorea or heart disease have been examined.

3. Most of the 20,000 children have had their tonsils removed for a period of five years or more.

4. Rheumatic fever, joint pains or growing pains occurred in both groups; 8 per cent of the tonsillectomized group and 10 per cent of the nontonsillectomized group had rheumatic manifestations. Many of the former had had rheumatic symptoms before tonsillectomy. The tonsillectomized child not yet infected has a decidedly better chance to escape rheumatic infection over the same period of time than the child whose tonsils have not been removed. Recurrent attacks of rheumatic fever were less common in the group in which operation had been performed.

5. Chorea occurred only slightly less often, 0.4 per cent as compared to 0.5 per cent in the tonsillectomized group. The incidemce of carditis following chorea was decidedly less in the tonsillectomized children.

6. Scarlet fever occurred in 7.6 per cent of the tonsillectomized children, and in 18 per cent of the non-tonsillectomized group. The children whose tonsils had been removed who developed scarlet fever developed considerably less valvular heart disease than those with scarlet fever in the control group.

7. Rheumatic heart disease was found in 450 of the 20,000 tonsillectomized children and in 817 of the 28,000 who were not operated on. Many of the children in the former group developed heart disease before tonsil enucleation. A careful analysis of 478 cases of carditis showed that in 83 per cent the condition developed before tonsil removal, and in 17 per cent following tonsillectomy.

8. Based on a control study of 20,000 tonsillectomized children, it must be concluded that the tonsil is a factor in the causation of rheumatism, scarlet fever and chronic heart disease. The tonsillectomized child is assured greater precaution against these infections than his companion whose tonsils have not been removed.

A most comprehensive article on the "Clinical Consideration of Inflammation and infection of Extratonsillar Pharyngeal Lymphoid Tissue before and after Tonsillectomy," was presented before the Triological Society by Wood. His observations may be summarized as follows:

The lymphoid tissue so often seen in the pharynx and on the posterior pillars following complete tonsillectomy may act as a focus of infection. That such a sequela will take place in a given case may often be suspected preoperatively by a study of the general lymphoid characteristics of the patient. On this basis, patients may be classified as follows: (1) those with a general diathesis toward general lymphoid hypertrophy; (2) those in whom lymphoid hypertrophy is confined to the tonsils or other areas; (3) those without any lymphoid hypertrophy, but in whom the tonsils are infected, and (4) those whose lymphoid tissue is normal in appearance until some cold or infection results in hypertrophy or in whom this takes place following tonsillectomy.

The postoperative prognosis varies in these four types of patients. In the first, locally it is bad, as a general lymphoid hypertrophy will occur; in the second, it is better, if nasal abnormalities are not present; in the third, it is excellent, and in the fourth, uncertain.

So far as the symptoms attributable to the focus of infection are concerned, these appear to lessen with the removal of the infected lymphoid tissue. Poor results without improvement or even worse symptoms will follow if the remaining lymphoid tissue becomes hypertrophied. This is the reason for the failure of tonsillectomy to cure generalized symptoms in so many patients. Again, after this operation, the remaining lymphoid tissue may cause local inflammation with compensatory hypertrophy.

The symptoms of nasal sinusitis are often insignificant until following tonsillectomy the remaining lymphoid tissue becomes infected, after which there may be a secondary infection of the antrum or ethmoid. The same is true of many infections of the middle ear, which would not have developed but for secondary pharyngeal lymphoid hypertrophy and infection.

ANATOMY AND PHYSIOLOGY

During the year of 1927, there was a striking absence of anatomic studies on the tonsil. Kingsbury and Rogers, however, published a long and comprehensive article on the development of the tonsil of the calf, which throws further light on the embryology of the human tonsil.

The experimental and clinical data of Russ, Suchanek and Pichler on the physiology of the tonsils is a most commendable piece of investigative work which is a study of the tonsils in relation to the blood picture and the organs of internal secretion.

Vigo Schmidt continues his extensive investigations on the function of the tonsils. As a result of his experience, he states that the supposed active material in the tonsils is produced in the lymphatic germ centers in the young, is specific in them, has a small molecule, and is thermostabile in acid liquids but broken up in alkaline liquids. The cessation of the effect—leukopenia—obtained by the injection of tonsillar extract soon after the extract is made alkaline suggests that the material may be similar to a hormone.

In another of Schmidt's studies on the function of the tonsils, he cites a number of the old theories and has propounded a new theory based on the immunizing properties of leukocytes. Heiberg's studies have shown that the germinal centers in the tonsils destroy lymphocytes instead of producing them. He supposes that the lymphocytes when destroyed liberate endolysins as do the polymorphonuclear leukocytes in an inflammatory process. Thus an antitoxin may be produced at the portal of entry of most infections into the body.

Very small inflammatory changes in the tonsils produce marked leukocytosis. This is merely a mobilization of leukocytes from deposits through the process of positive chemotaxis. The author suggests that the tonsils may exert a marked influence on the mobilization of leukocytes.

He performed eighteen experiments on persons with normal tonsils which consisted simply in massaging the tonsils and making a series of blood counts immediately before and after the massage. All eighteen showed marked leukopenia beginning five or ten minutes after the massage and reaching a maximum in from twenty to twenty-five minutes. This reduction was largely due to decrease in lymphocytes. Twelve control experiments carried out on tonsillectomized persons failed to show any change in the leukocyte count.

He concludes from these experiments that a lymphocytic antitoxin is produced in the germinal centers which, as a result of the massage, enters the blood stream in larger quantities than is normally the case, thus producing the observed lymphopenia.

Six experiments were performed on persons suffering with chronic tonsillitis. Some of them showed marked leukocytosis (due to increase in polymorphonuclears). The experiments were stopped because two of the six persons developed rheumatic fever within twenty-four hours.

PATHOLOGY AND BACTERIOLOGY

Although benign tumors of the tonsils are not extremely rare, a great variety of types occur. Kalina reports a case of fibrolipoma of the tonsil. Trible reports a case of angioma of the tonsillar fossa. The tumor appeared in the fossa after a previous tonsillectomy; it was about the size of an English walnut and had the color of normal mucosa. It did not pulsate and was regular and smooth in contour, giving the appearance of a cyst. It was removed and roentgen-ray treatment applied to the fossa. Pathologic examination showed a nonmalignant hemangioma with a fibromuscular myxomatous base.

In the study of lymphoid tumors of the tonsil, Pearlman and Pilot state that the majority of new growths originating from the tonsils are malignant. Fibromas and papillomas are the most common types of benign tumors; but besides these, lipomas, myxomas and cysts occasionally are encountered. Pure lymphoid neoplasms of the tonsils are among the rarest varieties of tonsillar growths. Only a small number of such cases is reported in the literature. The authors review the cases which have been reported. Four specimens are illustrated, and pathologic reports are given.

In all the growths described, the outstanding picture was the occurrence of hyperplastic or diffuse lymphoid tissue similar to the lymphoid tissue of the tonsil itself. It is probable that they represent an unusual formation of hyperplastic lymphoid tissue rather than true new growths of the tonsil.

A possible explanation for the occurrence of these lymphoid tumors may be found in the experimental investigations of Waldapfel. He

found the appearance of lymphoid hyperplasia and an increase in the number of follices in the tonsils of guinea-pigs and dogs following the experimental introduction of infection.

Stoker reports a case of tonsillar hypertrophy in lymphatic leukemia. Silbriger reports an interesting case of tuberculoma of the lingual tonsil. There was no evidence of pulmonary tuberculosis. The presence of cartilage and bone deposits in the tonsils in keratosis pharyngis is reported by Tanaka and Oda.

Krumbein reports two unusual pathologic conditions. In one case, multiple horny cysts were found in the adenoid, and the other case was one of tonsilla papillata vera.

In a further investigation concerning the changes in the lymph follicles in angina lacunaris, Waldapfel states that the lymph follicles are free from great quantities of leukocytes in all sections of clinically normal tonsils. In tonsillitis a mass of leukocytes is found in most follicles a day after the clinical height of the disease. The epithelium is densely infiltrated with leukocytes, which in some places wander to the surface in masses. These cells are found in large quantities only in the interfollicular tissue, which contains vessels, and in the so-called germinating centers. During the next few days, the picture becomes normal. Large cells appear in the follicles. They contain granules which are apparently reticular cells and seem to have absorbed leukocytes which have perished. The lymph follicles and their germinating centers are not exclusively places of production of lymphocytes.

A great deal of attention has been directed to the subject of monocytic tonsillitis. The evolution of the case described by Carnot, Weissenbach, Boltanski and Weill was longer than usual in this disease, the fever lasting three weeks. The general condition was also more affected. The hyperleukocytosis was exclusively due to the increase in the number of monocytes, the polymorphonuclears and the nongranular and lymphocytic mononuclears being diminished in numbers relatively and absolutely. The fusospirillary combination predominating in the flora of the tonsillar ulceration has at times been observed in tonsillitis with monocytes.

Haken reports three fatal cases of monocytic tonsillitis in children. Fusiform bacilli and spirochetes were found in one, cocci in another and diphtheria bacilli in the third.

Koenigsberger believes that the lethal cases of monocytic tonsillitis described by Haken were in reality, malignant diphtheria.

Observations on the histology of lymphatic tissue removed during the course of infectious mononucleosis and on staining by the supravital technic of cells from a lymph node in one case are reported by Fox. The lymphatic tissue showed marked hyperplasia, notably of the small lymphoid cells and to a less extent of the large mononuclears. Phago-

cytosis of fragments, but not of whole cells, was seen. The lymphocytes appeared soft and degenerating. By supravital staining the cells corresponded with lymphoid elements. Monocytes were not seen.

The histology of infectious mononucleosis does not seem distinctive unless it be that there is a marked hyperplasia of all elements with an attempt to retain the architecture of the lymph node. According to the tissue in the case, however, there should be no confusion with any chronic adenopathy of the lymph at the height of development of mononucleosis.

A study of the pathologic changes in the faucial tonsils was made in 1,000 cases by Welch. In 43 per cent of the cases there was no change, in 20 per cent there was scarring, and in 38 per cent concretions were present.

Nelson's report on the microscopic pathology of chronic tonsillitis was based on a study of about 2,000 pairs of tonsils and the accompanying adenoids when present. He summarizes his observations as follows:

> A rapid review of the processes above gives a composite picture. Infectious menace is first seen in the tonsil by an inflammatory reaction and leukocytic migration into the epithelium and space of the crypts and by hyperplasia of the lymphoid follicles; a prolonged encounter of attacking organisms and leukocytes destroys the cryptic lining, and granulation barriers form; by profileration and contraction of these granulations an attempt is made to obliterate the septic space from below outward, but the depth and ramification may pervert this process so that purulent pockets are obstructed or walled off to form abscesses; fibrosis of the stroma commences to strengthen the barrier, but this in time destroys the active elements without extruding the offending matter; as the capsule and peritonsillar tissue become involved in the chronic inflammatory reaction, fibrosis and thickening occur, and cartilaginous and bony walls of defense may develop. However, these barricading efforts of nature seldom succeed in expelling the invading hosts from the cryptic labyrinth, although complete destruction of the essential tonsil structure and extensive degenerative changes may be produced.
>
> Simple lymphoid hyperplasia is the most common process in the adenoid; it does not differ from that in the tonsil, although its mechanical effects are of greater moment. Purulent nasal discharge may collect on the adenoid and in its "crypts," and some intrinsic pathologic process may be present and obscured beneath this extraneous contamination. The adenoid "crypts" are less complex and are dependent, while the adenoid is not buried but protrudes. Despite these advantages, actual chronic inflammation as evidenced by ulceration in the crypts and the formation of granulations and purulent exudate, is sometimes seen here as in the tonsil. As a result there is an occasional chronic focus of infection in the adenoid.

In a study of the bacteriology of excised tonsils Kilduffe and Hersohn examined 409 tonsils. The most frequent organisms found were: *Staphylococcus aureus,* 33 per cent; *Micrococcus catarrhalis,* 34 per cent, and pneumococcus, 54 per cent—organisms not usually associated with the diseases often attributed to focal infections. Streptococci were present in only 6.4 per cent.

Busson reported a case of spirillosis following tonsillitis. After tonsillectomy, there was fever, enlarged cervical glands and expectoration of pus. Spirilla were cultured from the blood and were also found in the sputum.

Pilot states that in the routine examination of many hundreds of tonsils, chronic abscesses were often encountered, but in only three instances were the lesions associated with both fusiform bacilli and spirochetes.

The striking features of these abscesses were their chronic inflammatory character with a tendency to necrosis and the production of a foul-smelling exudate. Other bacteria, especially streptococci, also appeared in cultures.

The tonsillar lesions associated with these bacteria resemble the lesions observed in certain forms of pulmonary abscess and gangrene. It is interesting to note in this connection that fusospirochetal pulmonary infection may follow tonsillectomy. The middle ear and the sinuses may also become infected with these organisms.

COMPLICATIONS

As a result of the large number of operations on tonsils and the large number of tonsil diseases observed each year, there is a certain percentage of cases in which complications occur. Since hemorrhage and abscess of the lung are considered the most serious complications, more attention is naturally directed to these phases of the subject. In the German literature, the interest in peritonsillar abscess as a complication is particularly noteworthy.

In Leicher's article on tonsillectomy in peritonsillar abscess, he advocates the removal of the tonsil on the side of the abscess. In this connection, the observations of Haardt are interesting. He removed the tonsils from twenty-one patients from two to seven days after incision of a peritonsillar abscess. In nineteen cases, the results were satisfactory, but in two, postoperative sepsis developed. He has returned to his former practice of waiting for complete subsidence of the acute inflammation before excising the tonsils, except when satisfactory drainage of the abscess is impossible, when incision is followed by hemorrhage or when a septic condition fails to improve after incision.

Hofer, in his paper on tonsillectomy in abscess of the tonsil, outlines the reasons for and against operation. He reports a series of cases in which tonsillectomy was performed with good results. He also describes the technic of operation under general anesthesia.

Kasche reports a fatal case of cervical abscess and sepsis following tonsillectomy.

According to Zange, postanginous pyemia is the most dangerous complication of tonsillitis. It frequently develops after a peritonsillar

abscess or a retrotonsillar phlegmon. As a rule, primary thrombophlebitis of the tonsillar veins is present with or without propagation of retrotonsillar thrombophlebitis to the jugular vein. Occasionally, the cause is found in the lymph channels and glands of the neck.

Treatment should consist of incision of the peritonsillar abscess or removal of the diseased tonsil under conduction anesthesia of the cervical plexus. The affected veins of the jugular vein or the jugular vein itself must be ligated.

In less severe cases only enucleation of the tonsil, and sometimes only incision of a peritonsillar abscess, is necessary. Chills may occur. Metastases may occur in the joints, muscles, skin, parotid, ear, orbit or lungs.

Zange observes three grave cases in which all the patients died and three less severe cases in which the patients recovered. Five cases reported in the literature were cited.

Hemorrhage following the removal of the tonsils and adenoids has always received much attention. McNally reports his observations on 1,416 operations. Almost all were performed under ether anesthesia. Eighty-nine per cent were performed by the dissection and snare method and 11 per cent by the guillotine method. Severe postoperative bleeding occurred in 0.7 per cent by the former and 2.6 per cent by the latter method. Adenoids were removed with the La Force adenotome, and bleeding occurred in 0.4 per cent of the cases. There were five cases of primary and fifteen cases of secondary bleeding after tonsillectomy and no primary bleeding from the adenoids.

Moritz reports his observations in 417 cases and outlines the etiologic factors. Of twenty-five serious hemorrhages, eighteen occurred in adults and seven in children. He advocates complete control of bleeding at operation by ligation of vessels.

Detay writes on the prevention of postoperative hemorrhage and Mead discusses the factors helpful in preventing post-tonsillectomy complications.

During the past year much attention has been directed to bronchoscopic observations in tonsillectomy and to abscess of the lung. From the bronchoscopic and esophagoscopic observations in tonsillectomies, L. Daily and R. K. Daily draw the following conclusions:

1. The greatest percentage of tonsillectomy cases operated upon contain blood in the tracheobronchial tree.

2. The pharyngeal and swallowing reflexes have a more determining effect than the laryngeal reflex upon the absence or presence of blood in the lungs.

3. There is a relation between the presence of blood in the tracheobronchial tree and in the stomach. Usually where there is blood in the one, there is none in the other and vice versa.

4. Anesthesia in which the pharyngeal and swallowing reflexes are not abolished should be the one of choice to prevent blood from entering the tracheobronchial tree.

5. The tonsils should be removed under light anesthesia, deepened afterwards if necessary to check bleeding.

Pulmonary abscess following tonsillectomy was the subject of investigation by Ochsner and Nesbit. They state that theoretically infection may be carried to the lungs by one of the following routes: (1) the lymphatic system, (2) the cardiovascular system and (3) the tracheobronchial tree. The embolic and aspiration theories are discussed in detail. The embolic theory has been proved and accepted. In consideration of the aspiration theory, it is logical to assume that infection may gain entrance to the lungs by way of the tracheobronchial tree, especially in a patient whose reflexes are abolished. This mechanism explains the development of a pulmonary abscess following a tonsillectomy performed under general anesthesia. The authors proved that local anesthesia of the tonsils interferes with the normal protective reflexes and permits aspiration into the tracheobronchial tree. After the production of local anesthesia, they gave the patient a mixture containing iodized oil to swallow. By means of the roentgen ray they demonstrated that some of the mixture entered the tracheobronchial tree. These observations remove the one objection to the aspiration theory of abscess of the lung following tonsillectomy.

Pulmonary abscesses have been produced by Smith in mice, guinea-pigs and rabbits by intratracheal inoculation of material scraped from the alveolar border of the teeth of patients suffering from moderately severe pyorrhea. The same morphologic types of organisms have been recovered from these experimental abscesses as were found in both postoperative and nonpostoperative pulmonary abscesses in man. Smith feels that aspiration of infected material from the teeth and tonsils probably accounts for the greater number of cases of pulmonary abscess, although a small number may result from infected emboli from the upper respiratory passages.

Tucker reports fourteen cases in which accidents with foreign bodies occurred during otolaryngologic operations and four cases of pulmonary abscess secondary to tonsillectomy. He emphasizes the importance of peroral endoscopy in the management of these cases.

Devine reports three cases of abscess of the lung following tonsillectomy, and Whitman reports one case.

A most unusual complication of local tonsillectomy, reported by McClintock and Trible, is interesting. They describe two cases in which edema of the fauces, soft palate and pharyngeal wall followed local tonsillectomy. Two per cent procaine in 0.8 per cent camphor water was used as a local anesthetic. The most probable cause seemed to be

the irritating effect of the camphor, which produced chemosis, edema, strangulation, impairment of heart action and edema of the lungs, with death in the first case; and in the second case, a chemosis and breaking down of the tissues with a staphylococcic invasion of the organisms which were present, but not multiplying, from a previous peritonsillar infection. An early low tracheotomy and localization of the infection and its surgical drainage from the neck saved the life of the second patient.

The observations of Forschner and Loos on facial paralysis after local anesthesia of the tonsils are most unusual. They report two cases and refer to the literature and personal communications concerning other cases in which facial paralysis appeared after the injection of the tonsils with procaine hydrochloride. The paresis or paralysis disappeared within a few hours. They made four anatomic preparations in which the extent of the infiltration was noted. It was found that the parapharyngeal space was infiltrated laterally to the region of the parotid gland where the facial nerve could be affected.

Buchband reports a case in which erysipelas of the mucous membrane of the uvula and soft palate followed tonsillectomy. The erysipelas later involved the auditory canal, external ear, cheek, eyelids, forehead and neck.

Meningitis complicating local tonsillectomy and resulting in death was reported by Jacobsen. Baratoux discusses the consequences of injuries to the palate in the course of operations on the tonsils.

TREATMENT

Most of the material on the subject of the treatment of tonsils has been confined to methods of application of electrocoagulation and the control of hemorrhage.

In considering the injurious results that frequently follow tonsillectomy, Rice advises against tonsillectomy in singers, contending that the operation is followed by dry catarrh of the pharynx and larynx and deformity of the pharynx.

The question of the advisability of including the plica triangularis in the removal of tonsils has been most comprehensively presented by Fowler.

His summary is as follows:

> In favor of leaving the plica mucous membrane in place it is claimed: 1. That in singers this does much to prevent any change in the voice. The scar following the tonsil operation is less, and the pillar muscles are not bound to each other. 2. The cosmetic result is better and the throat heals more rapidly, with less pain and discomfort to the patient.
>
> In favor of removing the whole plica triangular is with its mucous membrane, it is claimed: 1. that this prevents small points of infection being over-

looked. which cause cervical adenitis. 2. That incision along the edge of the palatoglossus muscle affords the quickest and easiest approach to the capsule, and thus makes the operation faster and easier to perform.

Conclusions: The upper two thirds of the mucous membrane of the plica triangularis may be left attached to the anterior pillar, and the lower third with the infratonsillar nodules removed with a snare, thus gaining the advantages that are claimed for each of the more extreme measures. The astute surgeon will find an opportunity to use his judgment in each individual case, keeping in mind that although the infratonsillar nodules are not strictly a part of the tonsil itself, they form part of the Waldeyer's ring, and if left in the throat occasionally give trouble; keeping in mind also that the preservation of as much mucous membrane as possible will give the best cosmetic results, will preserve the quality of the voice and will lessen the tendency of scars attaching to the base of the tongue.

Harris and others report results of the removal of tonsils and adenoids in a series of ninety diphtheria carriers. Seventy-six became negative at once. Diphtheria vaccine did not produce any results of value.

McKinney makes observations on the coagulation test and bleeding time in 982 cases. He reports five cases in which he shows that the coagulation test and bleeding time are without clinical value. He says that the family history is the best guide in determining whether the patient is a "bleeder."

Foote and Selinger study the postoperative leukocytosis and rise in temperature in children subjected to tonsillectomy, dividing their material of 147 cases into four age groups. The ages ranged from 5 to 13 in all groups. The average leukocyte count before operation was 11,300; five hours after operation 15,000; twenty-four hours after operation 14,500. In general, one may expect a leukocytosis of from 3,000 to 4,000 about five hours after tonsillectomy. Leukocyte variations in the twenty-four hours following an operation have no demonstrable relation to variation in temperature.

Electrocoagulation as an adjunct in the tonsil dissections is discussed by Taylor who has designed a special pair of scissors with electrical connections so as to produce coagulation of the tissues as the dissection is carried out.

Hollender and Cottle designed snares for the purpose of electrocoagulation. One type of snare used in tonsillectomy insures a bloodless operation. The other type of snare is advocated for use in the nose in removing polypi and turbinates.

Another type of electrocoagulating instrument used for tonsillectomy was designed by Herman. The new instrument is made on the order of the Beck-Schenck type with connections for producing electrocoagulation. This method is claimed to insure a bloodless operation.

Dillinger also writes on the technic of electrocoagulation (diathermy). McFee uses the monopolar high frequency spark.

Buff employs an instrument similar to the type designed by Herman.

In Denman's paper on the treatment for tonsillar lymphoid hyperplasia with roentgen ray and ultraviolet light, he speaks of the susceptibility of this type of tissue to radiation. He remarks that this treatment is particularly applicable to the eustachian tube.

Scal's report on the treatment of diseased tonsils by means of radium consists of a series of more than 100 cases, and his observations extend over a period of three years. The method is advocated in those cases in which tonsillectomy is indicated but in which surgical intervention is inapplicable. Three methods of treatment were employed and six cases are reported in detail from each group. He gives the results of each method and points out the one which is the most satisfactory.

Milligan advocates diathermy as the most effective agent in the treatment of malignant disease of the tonsil. He states that it is superior to radium, but advocates the use of it after diathermy to insure deep penetration of the surrounding tissues.

Four authors (Brown, Kerr, Shuster and Wells) designed new instruments on the order of the hemostatic clamp for the purpose of placing sutures in the tonsillar fossa. Doyle describes a new forceps for use in applying pressure to the tonsillar fossa, and Rauch describes a new tampon hook for holding a sponge in the tonsillar fossa.

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Miscellany

PROFESSOR SIEBENMANN'S SEVENTY-FIFTH BIRTHDAY

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The seventy-fifth birthday anniversary of Dr. Fritz Siebenmann, retired professor of diseases of the ear, nose and throat at the University of Basel, was celebrated on May 21, 1927. He well deserves both the heartiest congratulations and a fitting recognition of his accomplishments in his specialty. True, much and good work had been done before Siebenmann, but when he began, he found a pathology of the ear which, to a great extent, had little connection with clinical observations, and in the clinic, a diagnostic nomenclature which had no pathologic background. If there is today a scientific otology by which a diagnosis means one certain pathologic condition, and by which the pathologic condition can be diagnosed on the living, it is due to the perserverance of Professor Siebenmann and to the favorable conditions, hard to duplicate elsewhere under which he worked. Among these, the financial considerations, although of great importance, took second place.

Professor Siebenmann, the son of a minister, studied medicine at the universities of Zurich, Wurzburg, Bern and Paris. After graduating in 1875, he served as an assistant of Professor Kocher in Bern. For ten years, he was a general practitioner in the old town of Klosters, and was always especially interested in diseases of the ear, nose and throat. This brought him in contact with Burkhardt-Merian. With the intention of preparing himself in his specialty, he went to Vienna, Berlin, Halle and Breslau, but everywhere he found the same hopeless and sterile routine employed. A change came when he met Bezold in Munich, who, in constant contact with the professors of physics of the university made systematic functional tests of the organ of hearing. Siebenmann recognized at once the importance and possibilities of this deviation from the general routine, and from the first the relations of the two men ceased to be those of teacher and student and became those of friend and collaborator.

In making quantitative tests of hearing, Bezold used speech, which is still the simplest and most practical instrument. In qualitative tests he recognized two different kinds of hearing: hearing transmitted through the air and hearing transmitted through the bone. He accepted these as facts without trying to explain them. He established the relation between the two in the normal ear, and compared this relation with the conditions in the ears of all persons who were hard of hearing, especially in those ears that did not show visible changes from the normal. He found that the deviations from the normal did not vary under the same conditions in the same patient, and that certain groups of changes always appeared together, so that one set of patients showed one group and another set, the other group. Bezold and Siebenmann suspected from the beginning that one group belonged to patients suffering from disorders of the sound-conducting mechanism and the other, to patients suffering from disorders of the sound perceiving apparatus. Siebenmann undertook the task of furnishing the proof, which, in the course of time, meant nothing less than a complete reinvestigation of the pathology of the ear. Microscopic technique advanced greatly

during the eighties, and it was evident that with improved methods better results and further insight into the pathologic changes could be secured. He had to first work out the microscopic technic suitable for investigation of the ear.

A number of reasons induced Siebenmann to locate in Basel. For hundreds of years, Basel had the tradition of fostering science and knowledge of all kinds. Since the middle ages, a long list of distinguished names gave evidence that the university as well as the government and the public were uncommonly free from prejudice and encouraged original investigations. The importance of this will become evident when one remembers the pitfall of all pathologic investigations, the postmortem changes. Other conditions in Basel were favorable. Only a few years before Siebenmann came to Basel, the death of Professor Burkhardt-Merian had been a great loss to the university. Furthermore, many of the leaders were still shocked by the calamity which befell them when Dr. Baader, a former editor of the *"Correspondenz Blatt für Schw. Aerzte,"* an extremely active man in every department of public life and science, was afflicted by the sudden loss of hearing, and for years walked among them only a shadow of his former self, though still in full possession of his mental faculties. He and his friend, Burkhardt-Merian, studied everything that was written about diseases of the ear; they came to the conclusion that little was known, not alone about the remedies or possibilities of cure or prevention, but about the pathologic and clinical aspects of the trouble. All efforts were only hopeless tuggings on the chains that held Baader down.

The final decision of Siebenmann to locate in Basel was based on the assurance of the full support of Socin, professor of surgery, who was most powerful in social, governmental and university circles. Socin was able to throw his whole moral weight in the scale when the question of the realization of what he recognized as a real progress was at stake. A few years previously when the views in surgery changed first to antisepsis and a little later to asepsis, he had his operating rooms rebuilt three times, each time at an expense of nearly 1,000,000 francs. The professor of pathology, Roth (author of "Andreas Vesalius"), also promised his undivided support. Siebenmann came to Basel in 1888, and two years later became lecturer (privatdocent) on diseases of the ear, nose and throat. He began with the study of the extent and arrangement of the mastoid cells, and soon his "Korrosions Anatomie" appeared. In the pathologic institute, Siebenmann examined the ears and nose of every cadaver before the postmortem examination was made (over 500 examinations a year). From the beginning, he had extensive postmortem material at his disposal. The frequent occurrence of cholesteatoma induced him to investigate this peculiar change in the lining of the middle ear. Later, he found similar changes in the nose, on the tonsils, in the larynx and even in the trachea (pachydermia). Then came his investigation of the blood vessels of the labyrinth. In the meantime, he had built up a private practice in diseases of the ear, nose and throat, and conducted a free clinic in his private office, where for two years I assisted him. His laboratory work was done in the early morning hours, starting at 3 or 4 o'clock. Early in this extremely active life, hardly three years after he started, he was temporarily incapacitated by repeated hemorrhages from the bowels. Malignancy was suspected, but after several weeks, the diagnosis of ulcer of the duodenum was definitely made. The treatment mapped out allowed him to resume his work after eight weeks, but for many years, he had to be careful about his diet. The support of his devoted wife helped him to overcome this obstacle as well as many others.

In the clinic, Siebenmann made regular tuning fork tests as early as 1890. As an example of his ability as a surgeon, one experience may be cited. During an operation on an extensive cholesteatoma in the winter of 1891, I held the facial nerve on a hook probe for more than twenty minutes. The facial canal was necrotic for 1.5 cm. Meanwhile, Professor Siebenmann removed necrotic bone and parts of the vestibulum and semicircular canals. The dura and sinus were exposed. The patient is still alive, and has not had any trouble since; he hears whispering at a distance of 5 cm. and never has had facial paralysis.

As a teacher Siebenmann was equally efficient, sometimes taking hours to explain difficult conditions of the drumhead or nose. In the summer of 1892, his clinic was removed to the General Policlinic Building. In October, I left him for the United States. In 1899, 1903 and 1909, I again spent several weeks at the clinic. In the meantime, some of his most important works had appeared. I read and heard a great deal of criticism. Knowing his severely critical attitude toward himself, I asked him on what he based his conclusions. He told me "uniformity of large numbers of findings, free from accidentals, and incidentals." No hypothesis was built on two or three ever so well stained and apparently faultless specimens of series of specimens. He always considered that perhaps a different way of preservation or a different method of staining might give different results. All the different methods of preserving, hardening, decalcifying, cutting and staining had to be tried out by himself and not by technicians. Finally, he became convinced that everything depended on fresh specimens. Two or at most three hours after death, the specimens had to be in the fixing Muller-formaldehyde solutions. Whoever has tried to fulfil this requirement will admit that without powerful protection this work would not have been possible. (The value of this procedure will become evident when the Boston meeting is discussed.) After he had settled some important points in his investigation, he gave the results in concise short publications which only occasionally gave an inkling of the tremendous amount of work which they represented.

The first recognition of his merits outside of his city and country came in 1895, when the German Board of Education offered him the professorship and chair of otolaryngology at the University of Breslau. Included in this offer were the following: full status and emoluments of a university professor with a pension for old age; room, board, laundry and incidentals for two paid assistants and also for two voluntary assistants; a clinic with several thousand new patients a year; a clinic building with an outdoor department and an indoor department with thirty beds, and with rooms for operations, treatment and hearing-tests to be built according to plans proposed by Professor Siebenmann and approved by the German authorities at an expense of up to 1,250,000 marks; a laboratory building to cost 750,000 marks; sufficient funds for equipment and instruments for clinic and laboratory; expenses and sufficient nurses for an outdoor and an indoor clinic; technicians for the laboratory, and sufficient funds for running the laboratory. He was to be allowed a number of hours each day for private practice. He might even retain his Swiss citizenship if he so chose. Professor Siebenmann considered this offer seriously as it meant a long step toward a premier position among Germany's otologists. He presented this offer to the Board of Education of Basel, and this board, recognizing his importance as teacher and scientist, duplicated the offer, and Professor Siebenmann stayed in Basel. This strengthened his position still more. The new clinic and laboratory were built so that they were easily accessible from his house and near the pathologic department. All obstacles to his investigations were removed; more funds became available. The best instruments and equipment were procured for the

clinic and for the laboratory. Many of the present day leaders in the profession were anxious to become his assistants. Everywhere and always he gave a wonderful example of untiring efficiency. In the clinic, he was a careful diagnostician and a resourceful, rapid operator; in the laboratory, a relentless self-critic. In hundreds of series of slides he proved what he had set out to prove: In all living persons in whom the functional tests showed the cause of hardness of hearing to be in the middle ear, it was found there, and when the diagnosis had been nerve deafness, the pathologic changes were found in the labyrinth, acoustic nerve or nerve centers. This was the only way this question could be solved. Nevertheless, these carefully ascertained clinical and pathologic facts, as well as the methods by which they were ascertained, evoked a great deal of criticism which is still being indulged in. Siebenmann was never afraid of honest scientific criticism, but he considered it mere prejudice when men of high standing in the medical profession opposed him while at the same time they had to admit that they did not even know the technic of the tuning-fork tests. Specimens that were removed from the cadaver twenty-four and thirty hours after death were compared with those of Siebenmann, who had earlier shown that from five to six hours after death, postmortem changes were liable to cloud the whole issue. Careful examinations of the ear in living persons by well trained, experienced men, and fresh specimens handled by qualified hands, were the "conditio sine qua non" of any progress.

After the possibility of a differential diagnosis of diseases of the middle ear from those of the inner ear was established, a clinical and pathologic study of the diseases of the labyrinth, acoustic nerve and the central parts of the organ of hearing followed. This led to a study of the clinical and pathologic changes of the higher degrees of deafness and deafmutism. They could now be systematized into the congenital, due to all kinds of congenital or hereditary influences; the acquired, due to old age, to infectious diseases, cerebrospinal meningitis, scarlet fever, diphtheria, mumps and other conditions and to peculiar poisons (salicylic acid, quinine, alcohol, smoking), and others due to overirritation. Studies of the latter lead to a wonderful series of experiments on various animals, using overirritation with different sounds, long and short exposures and explosions, until finally his experiments on birds brought a maturer understanding of the mechanism of hearing.

More than a year before the international meeting in Boston, Professor Siebenmann asked me whether I thought any special subject might interest his American colleagues. I suggested that a general review of the pathology of the ear would be à propos. For months he reviewed his enormous collections, selected about sixty specimens and had drawings made of them. (Professor Siebenmann confidentially told me the sum of money he spent for having these drawings made; it nearly staggered me.) Professor Denker and Professor Gradenigo, who had seen the drawings and specimens on the boat coming over, were full of praise. Dr. Goldstein and Dr. Loeb offered to have reproductions made, but Professor Siebenmann thought that anything less than lithographs might not do justice to the valuable material. At the demonstration in Boston, it was agreed that I should repeat the descriptions in English, but the material was so large that it would have taken too much time. In the specimens of otosclerosis, the frequent occurrence of pieces of primordial cartilage among otosclerotic foci demonstrated the basis of his theory of this disease. The frequent finding of degenerative processes in the cochlea and acoustic nerve should not be forgotten in our work in the clinic. During the meeting, I took Professor Siebenmann into the room in which a great many enlarged photo-

graphs of Manasse's pathologic specimens were being exhibited, and drew his attention to the thickened periosteum over some of the otosclerotic foci, which some men gave as proof of the inflammatory nature of otosclerosis. He asked me if I had seen any such thickening in my specimens. I had not. He said that he did, years ago, before he was aware of the importance of fresh specimens, but not since. Then he showed me on Manasse's pictures clumps of isolated epithelia in several pictures, in others epithelia raised from their base and in others whole rows of epithelia missing. He shook his head and said it would be extremely dangerous to draw any definite conclusions from such specimens.

A further similar example of Professor Siebenmann's demonstration of the pathology of the ear occurred in 1926, when Professor Nager showed his pictures and the lumiere plates of the pathology of deafmutism. Professor Nager gave full credit to this wonderful teacher, as do all his former assistants, Professors Oppikofer, Van Eicken, Luscher and many others in Europe, in the United States and in Canada. Personal contact with this man produced a lasting stimulus in otologic work. We all join in best wishes for his continued health. His prognosis for the future of otology will never be forgotten. The only possibility for further advance in otology can come by making careful functional tests on the living and equally careful postmortem examinations.

News and Comment

SEMICENTENNIAL MEETING OF THE AMERICAN LARYNGOLOGICAL ASSOCIATION

The Semi-Centennial Meeting of the American Laryngological Association will be held in the Hotel Raleigh, Washington, D. C., May 1-3, 1928. The guest of honor will be Sir St. Clair Thomson of London, who is an honorary fellow of the Association. A number of papers will be devoted to the achievements in laryngology during the last half century, both in civil life and in the Army and Navy during the World War. All members of the profession interested in laryngology are cordially invited to be present.

At this meeting there will be an exhibition (noncommercial) of instruments for direct laryngeal, bronchial and esophageal work, which will show the progress from the inception of this work up to the present day. American laryngologists who may have devised special instruments for this work and who may not yet have been approached on the subject are asked to communicate immediately with Mr. V. Mueller, % V. Mueller & Co., 408 South Honore Street, Chicago, who will have charge of this scientific exhibit. The exhibit will be kept intact during the meeting of the American Laryngological, Rhinological and Otological Society, which will follow the meeting of the American Laryngological Association.

Abstracts from Current Literature

Ear

TEST FOR HEARING IN THE NEW-BORN: THE CONDITIONED REFLEX. C. A. ALDRICH, Am. J. Dis. Child. **35**:36 (Jan.) 1928.

The author points out the difficulty in determining the presence or absence of hearing in infants and the fact that previous tests have been dependent on visible response of the baby to sounds. This response consists in a sudden start of the entire body, winking of the eye and crying out, or a combination of these activities.

In a recent attempt to solve this problem he devised the plan of using what he calls the conditioned reflex, with sound as one stimulus and pain as the other. In this instance, at half hour intervals a small concealed bell was rung beside the baby's crib, while at the same time the sole of the foot was scratched with a pin. When these stimuli were applied the child cried out and drew up the leg. After twelve or fifteen applications the infant cried and drew up the leg when the bell was rung and the foot was not touched. The author feels sure from this response to noise alone that the child heard, and suggests that this might be developed into a reliable method of determining hearing in infants.

CONNOR.

MEASUREMENTS OF THE INTENSITY RELATIONS WITH THE CONTINUOUS TONE SERIES USED FOR QUALITATIVE HEARING TESTS. F. G. KATZ and E. MEYER, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:316 (Dec. 22) 1927.

1. The qualitative hearing test does not allow the determination of absolute tone limits, namely, the finding of total defects, but shows only the extent of hearing on an intensity level which changes from tone to tone, although within certain moderate limits.

2. The qualitative hearing test does not allow a uniform test of limits of hearing, because the required precision of the intensity, approximately in the sense of an "equi-intensity" of the tone series, is only roughly obtained.

3. The decrease of the upper tone limit, as found in the qualitative hearing test, does not furnish a reliable picture of the limitation for high tones, either for the total defect or for diminished sensation, because it furnishes only a single vague idea of the course of the threshold curve of hearing.

4. The qualitive hearing test always requires supplementary and controlling quantitative tests.

Ervin Meyer approached the question from the standpoint of the physicist. He used for the lower pitch (from 16 to 800 hertzian waves [namely, vibrations] per second), Edelmanns' tuning forks with weights; for the middle register (from 600 to 4,000 hertzian waves) two continually changeable lip whistles; for high tones (more than 4,000 hertzian waves) part of the time the galton whistle and part of the time Schulze's monochord improved by Struycken. Whereas the measurements can offer only qualitative importance in the practice, on account of the variation of sound production and on account of the employed order of testing, the conclusion must be made that the proper supposition of an "exact" qualitative hearing test, the use of constant pressure amplitudes for all frequencies, has not been met. A condenser microphone was used for measuring the effectual pressure amplitude of tuning forks, the two whistles and the monochord. The membrane was 2.5 cm. in diameter. It was surrounded by a rigid sound-screen of about 15 cm. in diameter. The method of sound measuring has been developed in the technical telegraph division of

the government. It is difficult to measure the pressure amplitude which affects the membrane of the microphone, but the correspondingly large electrostatic alternating pressure is easily measurable.

THE TRANSTUBAL INFECTION OF THE HEALTHY EAR. OSKAR BESELIN, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:329 (Dec. 22) 1927.

Besides through invasion by foreign bodies, infection of the middle ear through the tube can occur in two ways while the drum membrane is intact. Either a progressing inflammation or the injection of infectious fluid—for instance, mucus, pus or water—into the tympanic cavity can take place. When the tube is inflamed this cannot occur because the mucous membrane is swollen, but it can occur when the tube is healthy or dilated. It is surprising that the middle ear, on account of its connection with the nasopharynx, is not more frequently filled with secretion. This can be explained by various circumstances which form a natural protection. Only rarely do the conditions of an open tube, increased pressure and fluid in the nasopharynx present themselves simultaneously. Artificial transtubal infection through water, while bathing or while drinking from the faucet, is probable, and infection by douching of the nose under pressure is certain. The author tried to solve the question from the physical point of view through experiments with models made of glass. Air pressure was the essential factor; other physical factors were not essential. In order to calculate the necessary pressure, the volume of the middle ear cavities was measured for the first time (on the corroded specimen). When a sclerosed mastoid process was present, neither the pressure exercised by the lungs nor the pressure caused by instruments, employed by the author, could force secretion into the tympanic cavity. In a well pneumatized bone, transtubal infection was physically possible. The counterpressure of the air in the middle ear represented a further essential protection of the tympanic cavity.

It is unimportant to discriminate between progressive tubal infection and transtubal infection in otitis in suckling babies. The preculiar anatomic conditions make physical examination difficult. Transtubal infection probably occurs much more readily in a suckling baby or a child than in an adult. As a prophylactic measure, attention to the palate during tonsillectomy is important. In addition, a good nasal passage should be created. By these means transtubal infections will more readily be avoided. Caution should be observed in politzerization after adenectomy, especially when there is a liquid secretion in the nose or pharynx. This applies also to irrigation of the nose. Every ear should be treated as if there was a possibility of transtubal infection.

FREQUENCY OF OTITIC COMPLICATIONS OF THE BRAIN. K. RUEGG, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:345 (Dec. 22) 1927.

The statistics in this article are based on 27,899 reports of necropsies from the pathologic institute at Basel, from 1872 to 1927; on the histories from the ear clinic from 1897 to 1927 (3,175 acute and chronic cases of otitis, and 339 cases of otogenous intracranial complications), and on the annual reports of the university policlinic from 1897 to 1927 (56,324 patients with diseased conditions of the ears, among whom there were 25,203 with acute or chronic otitis).

1. An intracranial complication was the direct cause of death in 112 of 27,899 patients who came to necropsy in the pathologic institute, in 0.42 per cent.

2. Of 56,324 patients seen in the policlinic suffering from various diseases of the ears, eighty-six died in consequence of the ear trouble, 0.15 per cent.

3. Of 28,378 patients suffering from an acute and chronic otitis media, eighty-six died, 0.3 per cent.

4. Of 339 patients suffering from intracranial otogenous complications, the complication was solitary in 265 (78.2 per cent); and in seventy-four patients

(21.8 per cent) there were simultaneously two, or exceptionally more, intracranial complications. Among 422 otogenous intracranial complications (in 339 patients), 251 extradural abscesses were found (225 in the posterior cranial fossa, eleven in the middle cranial fossa and fifteen in both). Sinus phlebitis was found eighty-one times (among 422 complications), meningitis sixty-two times and abscesses of the brain twenty-eight times.

5. In 27,899 necropsies, abscess of the brain was found in 104 instances (0.37 per cent). In thirty-two of the 104 patients (30.8 per cent), the abscess of the brain originated in the ear. Of thirty-two abscesses of the brain, sixteen were found in the cerebrum, fourteen in the cerebellum and two in both.

Otogenous abscess of the brain was almost always solitary, whereas in nonotogenous abscesses one not infrequently finds two or more foci separated from one another. Of thirty-two otogenous abscesses of the brain, twenty-nine were solitary; in two instances there was a combination of an abscess of the cerebellum and the cerebrum, and once multiple cerebellar abscesses were found. Of seventy-two nonotogenous abscesses, forty-six were solitary and twenty-six multiple abscesses. In 27,899 necropsies, 129 cases of sinus phlebitis were found (0.4 per cent); of these, fifty-one cases (39.5 per cent) were otogenous. In the same number of necropies 1,141 cases of meningitis presented themselves (4.1 per cent); only seventy-four were of otogenous origin. Tuberculosis was the cause of death in 759 cases (66.5 per cent). In forty-two of the seventy-four cases (56.8 per cent), only meningitis was present.

6. Acute and chronic otitis and the various intracranial complications were more prevalent in the male.

7. Acute and chronic otitis and complications were found more frequently in the three first decades. Abscess of the brain was rare during the first decade.

8. Extradural abscesses were more frequent in cases of acute otitis. Acute otitis was present in 160 (80.5 per cent) of 200 cases, whereas abscess of the brain developed more frequently in cases of chronic otitis (eighteen of twenty-eight). Otogenous sinus thrombosis occurred forty-three times with acute otitis and thirty-eight times with chronic otitis; suppurative meningitis occurred sixteen times with acute otitis and fourteen times with chronic otitis.

Bacteriologic examination of pus taken from the mastoid process in endocranial complications revealed mostly streptococci and pneumococci.

9. Of 3,176 cases of otitis in the clinic, 42.3 per cent were on the right and 40.3 per cent on the left side, whereas 17.4 per cent were bilateral. Intracranial complications were also equally divided as to location.

AMBERG, Detroit.

Larynx

TRICHLORACETIC ACID IN THE TREATMENT OF ULCERATIVE LARYNGEAL TUBERCULOSIS. BERTRAM C. DAVIES, Ann. Otol. Rhin. & Laryng. **36**:816, 1927.

The successful use of acid trichloracetic pura in the treatment of Vincent's angina, led the author to try it in a case of tuberculous ulceration on the posterior surface of the epiglottis. The patient was much emaciated because of the severe dysphagia. The ulceration was first cleansed with peroxide, followed by an application of acid trichloracetic pura. Application was made by means of a curved wooden applicator, no cotton being used. The patient stated that pain was not felt, but a sense of heat which passed immediately. Within forty-eight hours the ulcer was seen to be clean and well covered with granulations; the pain was gone and she could swallow any kind of food or drink. Following the treatment, she began to gain in weight and a persistent cough of which she had complained, stopped. The author has since treated forty-two patients by this method with uniformly good results. The location of the ulcer does not influence the treatment. The acid is easily applied and frequent applications are not necessary. No routine is followed as to a definite interval between treat-

ments, the applications being given as indicated by the character of the ulceration. A simple touching up of small areas that have been slow in granulating is usually all that is required after the first treatment. The applicator used is the ordinary 7 inch wooden applicator, boiled, and while yet hot, molded into the regular curve of a laryngeal applicator. When dry they retain their curvature and may be used in the regular mirror handle.

When complete coverage with granulations has taken place, the author makes regular applications twice a week, for a period of two months, of chaulmoogra oil, 20 per cent in olive oil, in order to establish fibrosis and thus render the area firm and hard.

SNAPP, Grand Rapids, Mich.

Nose

MALIGNANT NEOPLASMS OF THE ANTRUM. GEORGE H. THOMPSON, Ann. Otol. Rhin. & Laryng. **36**:715, 1927.

Malignant growths involving the maxillary sinus occur more frequently than is generally supposed. Those of primary origin are by no means common, but secondary invasion of the antrum by growths arising in adjacent structures is not unusual. Ewing has recently reported that of 1892 patients treated at the Memorial Hospital, the condition was of nasal origin in 48 and in 35 of these the maxillary sinus was involved. New, of the Mayo Clinic, reports that in the eight year period from 1917 to 1924, 168 cases of malignancy of the antrum were encountered. One hundred and twenty-nine were primary, while in thirty-nine cases the growth was secondary to a malignancy of the upper jaw.

The author classifies these neoplasms of the antrum according to Ewing: (1) papillary, some of which are malignant transformations of papillomas; (2) carcinomas of the basal cell type, often designated as adenoid cystic epitheliomas; (3) squamous cell carcinomas, which are metaplastic from previously altered lining epithelium; (4) cylindrical cell carcinoma, a bulky tumor, unusually malignant; (5) round cell carcinomas of a typical structure, which is often designated as sarcoma; (6) dental tumors, including the squamous and glandular types of adamantinoma.

As regards the occurrence of the various types, Waugh classifies them as follows: (1) sarcoma—round cell, lymphosarcoma, fibrosarcoma and osteosarcoma; (2) epithelioma—basal cell, squamous; (3) malignant fibromyxoma, and (4) malignant tumors of mixed type.

Waugh finds that squamous cell epithelioma is most malignant, and the maxillary sinus most frequently involved. In New's series of 129 primary tumors of the antrum, 82 cases were squamous cell epithelioma; 9 were sarcoma; 4, lymphosarcoma; in 6 cases the type of malignancy was not determined, and in 13 of undoubted malignancy, microscopic examination was not made.

As to the etiology, a definite statement cannot be made. Various cases reported by different writers attribute the cause to a variety of factors, including chronic suppuration with polypoid formation, epithelial rests in connection with a tooth socket, cyst of the sinus, degeneration of fibrous polypi and trauma.

The predominating symptoms in these patients are those of a rapidly growing tumor, which fills the antral cavity and breaks through the wall of the nose or the pharynx. Boring or lancinating pain is often one of the early symptoms, but even at this time the growth may be well advanced. Other symptoms are bleeding, swelling, nasal obstruction and glandular involvement, although the lymph glands do not become involved as frequently as in malignancies of other localities. The prognosis varies greatly as there is a wide variation in the degree of malignancy of the different types of tumors. When encountered early and completely removed there seems to be less tendency for these growths to return than in any other form of malignant disease.

No definite line of treatment can be prescribed, as the method to be used must be decided in each individual case. The results of surgical intervention alone have been disappointing, and many efforts have been made to deal with

these neoplasms by other means, and all manner of combinations of surgical procedures with roentgen rays, radium and diathermy have been employed. The author, drawing from his own experience and observation of the various methods used by others, concludes that the combination of surgical intervention and radium is the best form of treatment for malignancy of the antrum at the present time. The surgical procedure followed consists of wide exposure of the growth and the free use of the cautery as described by New. The cautery used is a soldering iron at dull heat. Radium salts or emanation tubes are introduced into the antrum at the end of ten days or two weeks following operation. The use of radium alone in these cases has not proved satisfactory in the hands of the author.

NASAL MANIFESTATIONS OF ALLERGY. CHARLES H. EYERMANN, Ann. Otol. Rhin. & Laryng. **36**:808, 1927.

Nasal allergy manifests itself in various types, the most frequently recognized being that of pollenosis, or hay-fever, which is caused solely by pollen. The inhalation of allergic substances other than pollen produces the so-called "nonseasonal" hay-fever which is not as easily recognized as pollenosis and is often mistaken for primary nasal diseases. In a third class of cases, identical symptoms may be produced by ingestion of various substances, such as foods or drugs.

Pollenosis, or hay-fever, is produced almost wholly by wind borne pollen, insect borne pollen being a factor only when directly inhaled. This fact eliminates those insect pollenated plants which so many credit with causing the symptoms. In general, the insect pollenated plants are characterized by bright colored, conspicuous flowers which have a sweet odor; the pollen is heavy and viscid and is shed sparingly. This eliminates the majority of the garden flowers as well as the goldenrod. The popularly designated rose fever is found to be due to the pollen of the grasses, while the symptoms usually attributed to goldenrod are due to the pollen of the ragweeds.

The author classifies the hay-fever season in the central United States into three divisions: the first extends from about the middle of March to the middle or last of May and usually is due to the pollen of trees. The next season extends from the middle or late May to the middle of July and is due to the pollen of grasses. The offending pollen in the early part of this season is mainly that of June and orchard grasses and in the later part that of timothy and redtop. The third season in the locality described begins about August 10 to August 20, and extends to the middle of September, being definitely closed by the first killing frost. The pollen chiefly responsible for this type is that of the short or giant ragweed.

The allergic factors in the nonseasonal hay-fever are most frequently air borne substances, as animal eminations, vegetable powders, such as orris root, rice, corn, barley and wheat flower or dusts. Dust may include both occupational and house dusts and an enormous variety has to be considered. In those cases produced by ingestion it must be remembered that there are seasonal foods as well as pollens and that certain occupational dusts are related closely to the seasons. It is also important to note that definite cases of pollenosis are aggravated by eating certain foods, consequently the offending food must be eliminated as well as the pollen.

The author, realizing that only about 50 per cent of clinically suspected allergic cases give positive cutaneous reactions, attempted to add another diagnostic measure which might be of value in determining the existence of the allergic state; namely, a study of the cell content of the nasal secretion. The secretion was usually taken from below the anterior tip of the middle turbinate and was obtained from ninety-one patients. Fifty-nine cases of this group were definite hypersensitive cases and 72 per cent revealed the presence of eosinophils. Of the thirty-two who were considered as nonsensitive persons, only three, or 9 per cent, revealed the presence of eosinophils in the nasal secretions, and these were found in small numbers. The results, therefore reveal the presence of eosinophils in the nasal secretion in 72 per cent of allergic persons as con-

trasted with 9 per cent in nonallergic persons. The author believes that it is possible that the cytologic examination of the nasal secretion will help not only to differentiate nasal allergy from other nasal conditions, but may also assist in eliminating the element of doubt in obscure cases.

HYPERESTHETIC RHINITIS AND MYXEDEMA. FRANK J. NOVAK, JR., Ann. Otol. Rhin. & Laryng. **36**:829, 1927.

The possibility of a close relationship between hyperesthetic rhinitis and myxedema is discussed by the author, who reports a careful study of twenty cases, the results of which, he believes, will strengthen the assumption of the endocrine nature of the condition. Nearly all of the twenty patients had severe symptoms of sneezing and a watery discharge. Thyroid extract was administered to every patient, and they all presented some improvement, seventeen of the twenty being either cured or exhibiting definite cessation or marked improvement of symptoms. The author especially emphasizes the constant low metabolic rate, the pale, patulous, swollen nasal mucosa and the fact that these patients usually showed the clinical characteristics associated with hypothyroid secretion. On administering thyroid extract, the metabolic rate increased in every case, and as this reached normal, the symptoms—sneezing, watery discharge and mental depression—disappeared. In case the symptoms returned after a lapse of three or four months, the basal metabolic rate was again taken and in all such cases was found to be again low. Thyroid medication was resumed, and the symptoms once more disappeared when the basal metabolism reached a point within normal limits.

Concluding from the facts observed in his own cases and from the opinions of others, the author believes it is probable that hyperesthetic rhinitis is a symptom of a localized type of thyroid myxedema in which most of the changes are evident in the nasal mucosa.

SNAPP, Grand Rapids, Mich.

THE SPHENOPALATINE GANGLION. A. I. FELDMANN and M. F. IVANITZKY, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:353 (Dec. *22*) 1927.

1. The sphenopalatine ganglion is the local nerve center of the nose. It is frequently subjected to disease and should engage the serious attention of rhinologists.

2. For success in reaching the ganglion subcutaneously, an exact knowledge of the surrounding osseous structures is required.

3. In an investigation of the anatomy and topography of the ganglion, in addition to the usual methods, craniometric methods, roentgenography, transparency (Spalteholz) and elective staining of the tissues (Worobjew) must be employed.

4. The measurements of the pterygopalatine fossa are: anterioposterior diameter 6.2 mm., transverse diameter 9.1 mm. and height 18.3 mm.

5. Instead of the terms foramen opticum and foramen rotundum, the terms canalis opticus and canalis rotundum should be used.

6. The sphenopalatine foramen and the axis of the pterygoid canal lie on a horizontal plane.

7. The axis of the pterygopalatine canal does not form a straight line. It is frequently bent at an angle.

8. The palatine foramen is directed not only inward but forward.

9. The shape of the skull determines also the form of the pterygopalatine fossa, to a certain extent, and the direction of the adjacent channels. In persons with brachiocephalism the pterygopalatine canal is more vertical than it is in persons with dolichocephalism, in whom the upper end deviates considerably backward.

10. The position of the ganglion is either more sagittal or more frontal.

11. The methods of reaching the sphenopalatine ganglion subcutaneously by way of the orbital, oral or nasal cavities are either not aseptic or dangerous,

because vital organs in the orbital cavity may be injured. Besides, in many instances, they cannot be used.

12. The external method remains. In order to reach the ganglion, a needle which is slightly curved at the end is used. All other methods do not allow one to reach the ganglion, but only the lower portion of the fossa. They permit only an infiltration anesthesia.

13. With all methods of reaching the ganglion, an exact knowledge and observation of the depth and of the distance for the outer points is imperative. In 100 skulls, the distances were:

From the external lower angle of the orbital cavity	50 mm.
From the lower border of the zygoma	52 mm.
From the angulus frontotemporalis ossis zygomatici	47 mm.
From the middle of the upper border of the zygomatic process	50 mm.
From the spina nasalis anterior	58 mm.
From the foramen palatinum majus	28 to 30 mm.

Approximately 5 to 7 mm. must be added on account of the thickness of the soft tissues.

The author uses a straight needle, from 7 to 8 cm. long, which is slightly curved at the end. A pin indicates the direction of the curve. The opening of the hollow needle is on the side and at the very end of it. The needle is introduced under the anterior end of the zygomatic process, inward, forward and downward. The tuber maxillae indicates the direction. The tip of the needle is always in such a position that the outer curve is directed forward and the inner curve backward. When the outer curve glides over the tuber maxillae, the needle reaches the pterygoid canal and presses against it. The author succeeded in skulls in 100 per cent of the cases and also in cadavers. The method was used in living persons in comparatively few instances, but with success.

AMBERG, Detroit.

Miscellaneous

ACUTE OSTEOMYELITIS OF THE SUPERIOR MAXILLA IN YOUNG INFANTS. MURRAY H. BASS, Am. J. Dis. Child. **35**:65 (Jan.) 1928.

The author reports two cases of what he terms acute osteomyelitis of the superior maxilla in young infants, a condition characterized by fever, prostration, swelling and redness about one eye, a unilateral, purulent nasal discharge, swelling and softening of the alveolar border of the maxilla on the affected side, by the formation of abscesses in the hard palate, the alveolar border and the face between the eye and the nose, and the frequent discharge of sequestra and teeth from the resulting fistulae.

The author has been able to find reports of twenty-three such cases in the literature. The clinical picture is sharply defined but some confusion exists as to the pathogenesis. Many of the cases have been described as infections of the antrum of Highmore, others as osteomyelitis, and others as phlegmons of the orbit. The work of Onodi has shown that the maxillary sinus is present in infants but is very small, being on an average from 7 to 10 mm. in the dorsoventral dimension, from 2 to 3 mm. in the mediolateral dimension, and from 3 to 4 mm. in the superior-inferior dimension. It is possible to conceive of a sinusitis even in the new-born. The author feels that these reported cases more closely resemble an inflammation of the superior maxilla itself than they do an infection of the antrum. A probe passed through one of the alveolar sinuses enters a large cavity which is probably a dental sac and not the maxillary antrum because it is too large for the latter.

Gangrenous processes starting in tooth buds in the new-born in cases of sepsis or erysipelas have been described by various authors and constitute one possible etiologic factor. Other factors in the reported cases appear to have been injury at birth, either from forceps or difficult labor, or infection in the mother. Both of the author's cases showed *Staphylococcus aureus* in

the pus, and one showed the same organism in the blood. This speaks in favor of the osteomyelitic theory as positive blood cultures are often found in acute diseases of the bones.

The prognosis is not unfavorable, recovery resulting in eighteen of twenty-three reported cases. The discharge of teeth leaves a child without teeth over the affected area.

The treatment consists of keeping the fistulae open and removing sequestra as they appear. Localized abscesses may be opened and the resulting sinuses should be kept patent. Facial incisions in small infants heal with very little scar.

INCIDENCE OF RHEUMATISM, CHOREA AND HEART DISEASE, IN TONSILLECTOMIZED CHILDREN. ALBERT D. KAISER, J. A. M. A. **89**:2239 (Dec. 31) 1927.

The great problems in the control of heart disease in children are the determination of the unknown factors in the etiology and prevention of chorea, rheumatic fever and other infections which are assumed to be present before the heart valves are involved.

Sore throat may precede scarlet fever, chorea and rheumatic fever so that it is reasonable to view the tonsil as a possible portal of entry and perhaps a factor in the occurrence of these infections. It thus becomes important to define the relationship between the tonsil and these infections and sequelae and to know whether or not tonsillectomy safeguards the child against rheumatic fever, chorea and heart disease, if these infections have not already occurred, and whether, if they be present, the operation will prevent a recurrence.

Follow-up studies were made of 20,000 children on whom tonsillectomy had been performed in Rochester, N. Y., from 1919 to 1921, and on 28,000 unoperated children who were used as controls. These patients were school children living in approximately the same environment. The work included a history of the child's infections, emphasizing the rheumatic syndrome, particularly in those who gave a history of chorea, rheumatism or heart disease. A careful search was made for other foci of infection. The date of onset of rheumatic manifestations relative to the time of operation was particularly determined.

The author includes acute rheumatic fever, joint pains and the so-called "growing pains." These occurred in 8 per cent of the operated children and in 10 per cent of the unoperated group. Many of the former, however, had had rheumatic symptoms before tonsillectomy. The author concludes that the tonsillectomized child has a decidedly better chance to escape rheumatic infection over the same period of time than the child whose tonsils have not been removed, and that recurrent attacks of rheumatic fever are less common in the group in which the operation has been performed.

The incidence of chorea was only slightly affected by operation, 0.4 per cent of the operated group being involved as compared with 0.5 in the unoperated group. Cardiac involvement after chorea was definitely less in the operated children.

Scarlet fever occurred in 7.6 per cent of operated children and 16 per cent of the unoperated group. Operated children have less tendency to develop valvular heart disease after scarlet fever than those on whom operation had not been performed.

Rheumatic disease was found in 450 of the 20,000 operated children and in 817 of the 28,000 on whom operation had not been performed. Many of the children in the former group developed heart disease before the operation. A careful analysis of 478 cases of carditis showed that in 83 per cent the condition developed before tonsillectomy and in 17 per cent, after tonsillectomy.

The author concludes that the tonsil is a factor in the causation of rheumatism, scarlet fever and chronic heart disease, and that the tonsillectomized child is assured greater protection against these infections than the child whose tonsils have not been removed.

CONNOR.

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

Regular Meeting, Nov. 7, 1927

GEORGE F. FISKE, M.D., *President, in the Chair*

THROMBOSIS OF THE PONTILE CEREBELLAR REGION. Presented by DR. J. C. BECK.

B. P., aged 25, single, an office clerk, was awakened about midnight, July 8, 1927, by a sharp pain in the right frontal and temporal regions. This was accompanied by tinnitus, dizziness, a drawing sensation of the right side of the face and cramping of the right hand. Shortly afterward, without previous nausea, he vomited, the vomiting being projectile in character. He then became unconscious and was taken to a hospital, where a spinal puncture was made. The spinal fluid was bloody; the Wassermann reaction was negative. During the following three or four days, the patient was more or less irrational and experienced several attacks of unconsciousness. When he regained consciousness, dizziness, diplopia, partial paralysis of all extremities and complete paralysis of the right side of the face were present. The dizziness disappeared in about six weeks, and he regained almost complete use of the right arm and leg in two months. The diplopia and paralysis of the right side of the face persisted.

He gave a history of a urethral discharge four or five years before the present illness, which was unaccompanied by pain and cleared up in three or four days under the treatment of a physician. Otherwise, his past history was essentially negative. One brother had had pulmonary tuberculosis.

General physical examination showed slight diffuse enlargement of the thyroid gland. The capillaries viewed under the microscope showed meshing and sclerotic changes. Otherwise, the examination gave essentially negative results.

Neurologic examination showed the first cranial nerve to be intact. Examination of the second showed that the visual fields of the right eye were contracted on the temporal side. The fundi were clear. The third, fourth and sixth showed slight right external strabismus and diplopia when objects were viewed at a distance. The pupillary reflexes were good. There was lateral nystagmus, right and left, and vertical pupillary unrest. The extra-ocular movements were all good, except for slight paresis of the right external rectus. The seventh showed complete paralysis of the entire right side of the face, the muscles showing reaction of degeneration. Examination of the eighth showed that hearing was good. In the past-pointing test the patient did not become dizzy and did not past point. The ninth nerve showed right palatine paralysis; sensation on the right side of the palate was diminished. The tenth, eleventh and twelfth nerves were intact. Sensory examination showed that touch, heat, cold and pain were somewhat more acute in the right upper extremity, the upper part of the right side of the chest and the right side of the face. The motor power was good and equal in all the extremities. The patient walked with slight ataxia of the right leg, and his script showed ataxia of the right hand. The finger-to-finger, finger-to-nose and heel-to-knee tests were well performed. The joint-muscle sense was intact. The knee and ankle reflexes, and the biceps, triceps and radial reflexes were greatly exaggerated but equal. Pathologic toe reflexes, ankle or patellar clonus, and tremors or twitchings were not present.

The Wassermann and Kahn reactions of the blood were negative. The urine was normal.

LUPUS. Presented by DR. J. C. BECK.

H., a man, aged 36, was first seen eight or nine years previously with a complaint or nasal discharge, for which he was treated. He returned in 1921, complaining of his throat. Tonsillectomy was performed. In January, 1922, he returned again complaining of a thick, mucilaginous discharge from his nose, together with crust formation. The right vestibule and ala were red and swollen, and a large amount of mucilaginous discharge and crusting were present in the nose. The condition bore some resemblance to his mother's case, a report of which has appeared in a standard text.

Physical examination was negative at that time; smear and culture from the nose were negative, as was also the blood Wassermann reaction. He had a slight daily elevation of temperature.

A diagnosis of lupus vulgaris was made, and treatment with roentgen ray and radium was instituted, without benefit. In July the patient consulted a dermatologist, who substantiated the diagnosis and advocated the use of acid mercury nitrate and then of radium, without any better results. The lesion began to spread over the cheeks and into the nose slowly, without pain, spreading by formation of small tubercles. Radium therapy was continued until 1924, when alpine lamp therapy was commenced, the local use of scarlet red ointment, and then diathermic destruction of the advancing tubercles, without apparent benefit. At this time a section removed from the nose showed a nonsyphilitic inflammatory reaction.

In the latter part of 1924, the patient consulted another dermatologist (Dr. Pusey) who, in spite of a negative history and symptoms, made a diagnosis of syphilis and instituted antisyphilitic treatment, without beneficial effect. The progression continued over the face and cheeks, followed by cicatrization of the skin with subsequent atrophy. Treatment with tuberculin proved futile. The lesion remained somewhat quiescent until several months ago, when the soft palate began to exhibit signs of induration. A biopsy was performed on the palatal lesions, and the pathologist reported chronic inflammation with giant cell formation, a picture compatible with lupus. The wound healed readily, and symptoms referable to laryngeal involvement next appeared. Hoarseness was pronounced, and examination showed infiltration and nodulation of the larynx, with distortion of the epiglottis. The ventricular bands were also affected, but the true cords showed only slight involvement. The picture then remained as it was at presentation.

GLOSSOPHARYNGEAL PARALYSIS. Presented by DR. H. L. POLLOCK.

CASE 1.—Mrs. W., aged 26, a housewife, had had a nasal twang to her speech since the age of 10. The history of onset was indistinct, but the patient had not had diphtheria previously. A tonsillectomy was performed three years later with the hope of improving her voice, but did not have any effect.

Examination revealed absence of the uvula, a scarred soft palate, stumps of both tonsils and a much enlarged lingual tonsil. The larynx was normal. The palate pulled to the left when she said "Ah." The other cranial nerves were intact.

CASE 2.—S. C., a schoolboy, aged 10, awoke on the morning of Oct. 18, 1927, with an extreme nasal twang to the voice. He gargled with salt water, after which he vomited twice. There was no history of fever, chills or symptoms of disease of the upper respiratory tract, and he had apparently been in good health when he went to bed the previous night. Tonsillectomy had been performed twice about four years before I saw him. He had not had diphtheria.

Examination showed the soft palate to be pulled to the left when the patient said "Ah." The other cranial nerves were intact.

FACIAL PARALYSIS FOLLOWING RADICAL MASTOID OPERATION, WITH SPONTANEOUS RESTORATION OF FUNCTION AFTER ONE YEAR. Presented by DR. S. J. PEARLMAN.

A., a man, aged 30, had facial paralysis and otitis media for two months prior to his admission to the hospital. He gave a history of an attack of otitis media about six months before, but said his ear had been dry in the meantime. The usual radical mastoid operation was performed. Massive destruction due to cholesteatoma was present, but healing was uneventful. Nine months after the operation and eleven months after the onset of paralysis, spontaneous partial restoration of function occurred.

CYSTIC HYGROMA. Presented by DR. S. J. PEARLMAN.

A negro child, aged 3 months, had a cystic tumor on the right side of the neck, the size of a large orange, the nature of which had not been definitely determined. Needle puncture proved it to be multilocular, and different types of fluid were obtained from different portions; some of the specimens were straw colored and clear, and others were distinctly purulent.

TUMORS OF LOWER JAW—EPULIS (?). Presented by DR. S. J. PEARLMAN.

A colored man, aged 45, had a large tumor of the left side of the mandible, which had been present for several years. Histologic examination revealed tissue closely resembling sarcoma, with many giant cells. The tumor did not show a tendency for rapid growth, or lymph gland dissemination.

SARCOMA OF NOSE. Presented by DR. GEORGE W. BOOT.

A man was first seen about a year before presentation, and a diagnosis of sarcoma was made. The patient entered the Cook County Hospital, where histologic examination showed a mast cell sarcoma. Under radium therapy the growth disappeared but recurred. Another course of treatment was given, and the growth again disappeared. The growth apparently arose from the right lower turbinate and completely filled the right nares.

STRICTURE OF LARYNX. Presented by DR. GEORGE W. BOOT.

A girl, aged 18, gave a history of having worn a tracheotomy tube for two years. The entire back of the pharynx was a mass of scars, as was the tonsillar region. The larynx was gone. When she was first seen, Dr. Boot split the pharynx and passed a probe upward. He afterward dilated with ureteral sounds, running the dilatation up to no. 26, put in a rubber tube and left it for several days. He then was able to introduce a no. 36 sound. At about this time Professor Smeigelow was in Chicago and operated on this patient by his method. Apparently the wire was not placed through the tube in the right place, and a day or two later the patient coughed the tube out. Dr. Boot attempted to put in another by the Smeigelow method, but some hemorrhage and soreness were present, and he had to remove the tube; a few days later, he took out the wire Professor Smeigelow had left in. He then put in a soft rubber tube in much the same way, but split the tube, bringing one side down on one side of the tracheotomy tube and one on the other. The patient now had an opening through the stricture as large as the little finger.

TUBERCULOSIS OF PHARYNX. Presented by DR. GEORGE W. BOOT.

A man, aged 37, had complained of symptoms for only two months, but examination showed ulceration over the soft palate and pharyngeal wall. The epiglottis was much thickened, and two or three small tubercles were present over the surface. Examination of the lungs revealed the presence of râles.

CARCINOMA OF THROAT. Presented by DR. GEORGE W. BOOT.

A man, aged 48, presented a typical carcinoma of the throat. The blood Wassermann reaction was positive.

CARCINOMA OF ANTRUM. Presented by DR. T. C. GALLOWAY.

H. S., a man, aged 68, was presented to compare the results of diathermy with other methods of treatment. The patient was first seen one year before presentation at the Cook County Hospital, complaining only of nasal blocking of two weeks' duration. The left nostril was filled with beefy polyps, which on biopsy revealed medullary carcinoma. The man was first operated on by a surgeon from Philadelphia. The external carotid was ligated; an incision along Nelaton's lines was made with a radio knife and the antrum as well as the nasal chamber up to the sphenoid found filled with a tumor mass. An attempt was made to destroy this with a needle electrode. A month later there were numerous recurrences. Needle electrodes were again used, but with further recurrences. Button electrodes were then used, which give a coagulation effect roughly one half the diameter of the electrode beyond the point of application and produce destruction of carcinomatous cells even further away. The bone of the malar eminence and the orbital margin had been burnt, but cleanly sequestrated, and had healed with smooth healthy surface without recurrences for eight months. The lower lid was gone, but the eye was not involved and its vision was better than that in the opposite one. The physicians hoped later to close the wound with a pedicled flap from the forearm.

Their experience with surgical diathermy had indicated that one must go considerably beyond the apparent area of involvement to secure good results, for which reason button electrodes seemed much preferable, except when a sharply limited effect was necessary. Unlike the results after ordinary surgical intervention, however, if one does not get the entire neoplasm at the first attempt, it does not become disseminated and another application can be given.

DISCUSSION

DR. JOSEPH C. BECK: My associates and I have treated some patients by this method, and I have seen a good deal of the work of others. In Europe last summer I saw Holmgren do the work, and since my return I have treated four patients with malignant disease by coagulation. In the former cases in which electrocoagulation was used, most of the patients died from late hemorrhage from the carotid artery. I saw this happen in one case, in which an aneurysm occurred and could be seen to increase every day. Ligation of the carotid at that period was followed by hemiplegia. The result obtained in Dr. Galloway's case was splendid, and I believe that it was due to the fact that the coagulation prevents spread of the disease. There is no immediate hemorrhage and it sterilizes the field. An important fact is that so little pain is experienced from this method of treatment. I feel sure that neither radium nor roentgen-ray therapy could compare with the use of surgical diathermy in malignant disease.

DR. HARRY L. POLLOCK: I am interested in this result because I am treating a man for a similar condition which has been diagnosed osteosarcoma of the superior maxilla. I performed a biopsy, going as deeply as possible, but the report stated "chronic inflammatory tissue." Under two courses of deep roentgen-ray therapy the growth enlarged rapidly and the patient became toxic as the result of this method of treatment. After the second treatment, he was much worse than before. Roentgen-ray examination showed involvement of the upper part of the antrum, with the floor clear, the mass extending to the floor of the orbit. Four weeks ago, I used surgical diathermy, first destroying with the needle and removing the growth with a curet, then using the button electrode and securing complete removal of the growth. The patient did not experience any reaction,

did not complain of pain; he left the hospital on the second day following the operation.

This method had also been used in a patient with carcinoma of the tongue. Two thirds of the left side of the tongue was removed, and the man left the hospital the following day, not complaining of pain and with little reaction.

DR. T. C. GALLOWAY: This is a splendid method in certain selected cases, but I believe that it is not so apt to result in permanent cure in carcinoma of the tongue and pharynx as in other regions. There is usually extension beyond the apparent area of involvement, and the results have not been so successful in these cases. Still, I consider it the method of choice in these cases. In the patient presented, enlarged glands were not present.

DR. JOSEPH C. BECK: I think that I have learned a great deal about glands from Trotter of London, who performs an extensive operation for the removal of glands. I have seen several patients whom Trotter had treated in this way, and they were apparently well several years later.

MENINGITIS (LABYRINTHOGENOUS). DRAINAGE OF CISTERNA PONTIS LATERALIS: PRELIMINARY REPORT. Presented by DR. ALFRED LEWY.

A boy, aged 12, with a history of recurrent discharge from the left ear, the last recurrence of one week's duration with headache, insomnia and vomiting during the last three days, was admitted to the Illinois Eye and Ear Infirmary on another's service on Oct. 18, 1927, and was operated on at once for mastoiditis as an emergency. On October 21, spinal puncture was undertaken, but a dry tap resulted, and on October 22, Dr. Lewy was called in consultation.

At that time the patient presented the clinical picture of a severe progressive meningitis, with high fever. Cisternal puncture was attempted but had to be abandoned, as the boy stopped breathing when turned on the side. Dr. Lewy then completed the radical operation and uncovered a considerable area of dura in the middle and posterior fossae, enlarging the area especially over and behind the previously uncovered sinus, which appeared to be thrombosed. He then chiseled away the bone of Trautman's triangle, and continued mesially along the posterior surface of the petrosa, leaving a thin shelf of bone between the middle and posterior fossae. Bleeding was free and persistent. When he thought he must be near the region of the internal auditory meatus, he began separating the dura of the posterior fossa from the petrosa with a probe, which released a small quantity of curdlike pus, followed by a free flow of cerebrospinal fluid. A xeroform gauze drain was then inserted into the depths in which the probe had been as far as possible without pressure.

The following morning the boy was greatly improved. The highest postoperative temperature was 100.8 F.; it reached normal the fourth day after operation and remained so, with relief of all the subjective symptoms except a severe pain in the sacral region, which appeared before the spinal puncture and persisted for a week after the operation. The stiffness of the neck and the positive Kernig and Babinski signs were still present, though diminished in intensity, and he had developed a spontaneous horizontal nystagmus on both sides, upward nystagmus, and spontaneous past pointing to the right. On November 1, the leukocyte count was 20,600. The patient's tongue had cleared up; he was sitting up, and was eating and sleeping well.

The diagnosis and ultimate outcome were not considered certain. The case may have been one of saccus empyema, a deep-seated extradural abscess, or perhaps an abscess of the brain with localized meningitis. However, the severity and progressiveness of the symptoms, the spinal block and the persistance of the neurologic phenomena justified the belief that without the operation the immediate outcome would have been different.

Dr. Lewy considered the operation a logical approach for drainage in otogenic meningitis whether labyrinthine (as he thought this was) or not, and thought that if it did not accomplish any more than the relief of suffering it was justified.

He believed that drainage of the cisterna pontis lateralis was first proposed by Holmgren and Uffenorde. (Description of the anatomy, operative technic and reports of cases can be found in the proceedings of the German Otolaryngological Society, (*Ztschr. f. Hals-, Nasen- u. Ohrenh.*, 1925, vol. 12) in articles by Boss, Goerke, who reports two recoveries in five cases, and Blau, who reports one case with recovery although the condition was complicated with sinus thrombosis and cerebellar abscess. These articles were abstracted by Dr. Lewy for the ARCHIVES OF OTOLARYNGOLOGY (**3**:468, [Nov.] 1926).

The boy was now up and around, apparently well. A slight Kernig sign, exaggerated knee reflexes and occasional horizontal spontaneous nystagmus to the right and upward nystigmus still persisted.

AGRANULOCYTOSIS AND LEUKEMIA: CASE REPORTS. Presented by DR. ALFRED LEWY and DR. NOAH SCHOOLMAN.

Dr. Lewy's patient, a girl, aged 19, of Scandinavian descent, was seen in consultation on July 29, 1927. The family history contained one item of interest: a sister of about the same age had died a year before after a six days' illness that was diagnosed as quinsy. The patient had been dieting rigorously to reduce her weight, and gave a history of mumps, measles and chickenpox. Five weeks before the onset of this trouble, a lower molar had been extracted because of abscess. This was followed by a very sore mouth, which was improving when she developed a sore throat two weeks later. The tonsil was lanced, but pus was not obtained. When seen by Dr. Lewy, the girl was pale, even to her lips and nail beds, but was not greatly prostrated; her voice was muffled because of swelling of the throat, and the movements of the lower jaw were limited. The upper anterior groups of cervical glands on both sides were swollen but not tender; the breath was foul, and the tongue heavily coated a dirty yellow; the region from which the tooth had been extracted was covered by a grayish exudate. Both tonsils were swollen, particularly the left, which pushed forward the edematous anterior pillar; the uvula was swollen and edematous; the median surfaces of both tonsils were covered by a greenish-gray thick exudate which was difficult to remove. Swallowing was difficult because of swelling rather than pain. A probe puncture of the left tonsil produced moderate bleeding, but not any pus. A smear showed a predominance of *B. fusiformis* and spirilla; culture revealed chiefly streptococci (not typed) and not any Klebs-Loeffler bacilli. The white cell count was 4,000, only 75 of which were polymorphonuclears, the rest being small and large lymphocytes. The provisional diagnosis was agranulocytosis. Sulpharsphenamine was given. The following day, she was worse and was removed to the hospital. Blood transfusion, the feeding of liver and vegetable juice, and dilute hydrochloric acid were advised.

On August 1, examination of the blood showed: hemoglobin, 31; erythrocytes, 2,340,000; leukocytes, 3,500; polymorphonuclears, 2; small lymphocytes, 52, large, 36; transitionals, 10; 1 nucleated red cell; slight anisocytosis and poikilocytosis, and polychromatophilia.

On August 4, the hemoglobin was 34; erythrocytes, 1,700,000; leukocytes, 5,000; polymorphonuclears, 2; small lymphocytes, 53, large, 31; transitionals, 14; 2 nucleated red cells. Other conditions remained as before.

On August 5, the hemoglobin was 34; erythrocytes, 2,050,000; leukocytes, 7,000; polymorphonuclears, 1; small lymphocytes, 45, large, 34; transitionals, 20; other changes were the same as before.

On August 2 and 6, she was given transfusions of fresh blood. The temperature fluctuated between 101 and 105 F.

On August 8, the hemoglobin was 38; erythrocytes, 2,310,000; leukocytes, 4,300; polymorphonuclears, 7; small lymphocytes, 60; large, 32; transitionals, 1.

On August 9, she was seen again by Dr. Lewy, and showed a healed lesion which had been a bloody blister on the right upper eyelid. The spleen and

liver were barely palpable below the costal margin; there was a definite systolic murmur, loudest at the apex, with the impulse diffused to the left and lower than normal. Ankle clonus was marked on the left, less so on the right; the knee reflex and the Chaddock and Gordon signs were marked on the left. The Kernig and Babinski signs and the rigidity of the neck were not present. The swelling had extended to the floor of the mouth, as in Ludwig's angina, and the left tonsil had sloughed. Dr. Lewy still believed the trouble to be agranulocytosis; another consultant diagnosed noma. Following this visit, the patient spit blood on several occasions, had nosebleed twice, and once blood streaked mucus was found in the stools.

On August 10, the hemoglobin was 38; erythrocytes, 2,400,000; leukocytes, 4,700; polymorphonuclears, 5; small lymphocytes, 48, large, 47.

On August 12, the hemoglobin was 36; erythrocytes, 2,640,000; leukocytes, 4,900; polymorphonuclears, 3; small lymphocytes, 35, large, 60; transitionals, 1; basophils, 1.

On August 15, one hour before death, the hemoglobin was 32; erythrocytes, 1,860,000; leukocytes, 20,000; polymorphonuclears, 2; small lymphocytes, 40, large, 40; transitionals, 16; nucleated red cells, marked anisocytosis and polychromatophilia. The blood Wassermann reaction was negative; the urine showed a trace of albumin on one occasion; no casts; epithelial cells; a few erythrocytes and an occasional leukocyte. Blood culture on the seventh day revealed an organism which was identified as *Streptococcus viridans*. Autopsy was not obtained. The slide made one hour before death was examined by Dr. O. T. Schultz pathologist at Michael Reese Hospital, who reported many myeloblasts and myelocytes, and believed the condition to be an acute myeloblastic leukemia. Dr. Lewy considered the absence of a hemorrhagic diathesis to be in favor of agranulocytosis. He believed that the bleeding toward the termination of the disease could be accounted for by the local sloughing, and that the sudden increase in cells within an hour of death might have been an agonal affair.

Dr. Schoolman's patient, a well developed girl, aged 10, was admitted to Mt. Sinai Hospital on July 27, 1927, in a state of extreme exsanguination, air hunger and hyperpyrexia. The temperature on admission was 106 F., and death occurred two days later. According to the fragmentary history obtained, the child had been spitting blood for three weeks, and had had bloody vomitus and black stools. The parents stated that immediately preceding the onset the patient took a cold shower while overheated, and that night became ill with chills, fever and sore throat. It was also adduced that the patient passed through an attack of scarlet fever and diphtheria early in April, but had been considered well for two months prior to the onset of the terminal condition. On admission to the hospital there was a greenish-black, sloughing area in the region of the left tonsil, which emitted a foul odor and oozed blood. The cervical glands were not enlarged; she did not complain of sore throat and apparently did not have any difficulty in swallowing food. An attempt was made to control the active bleeding by removing the foul débris of the sloughing area and applying pressure. She was given hypodermoclysis. On the 28th, she received 300 cc. of whole blood intravenously. On the 29th, an attempt was made to ligate the left external carotid, and at the same time to inject more blood into the jugular vein, but death occurred before this could be carried out. Autopsy could not be obtained. Fever seemed to be the sole constitutional reaction. Dr. Schoolman was of the opinion that the persistent hemorrhage caused death, but Dr. Trace, an internist who was called in consultation, concluded that the case represented an instance of an essential disturbance in the blood forming organs, particularly the granulocytic system, which related the case to the not yet well charted clinical entity for which Werner Schultz proposed the title "angranulocytic angina."

DISCUSSION

Dr. Alexander A. Maximow: One must pay attention to two things in the human blood; first, the leukocyte; second, the monocyte. The latter has

been described by Ehrlich as partly a large mononuclear and partly a transitional form. The origin of the polymorphonuclear leukocyte is clear; it develops from the myelocytes, the difference between the myelocyte and the leukocyte being that in the myelocyte the nucleus is capable of division, while in the cell which circulates in the blood this is impossible. The decision regarding the origin of the monocyte is not settled, but work done in Dr. Maximow's laboratory seems to show that the majority of these cells are simply transitions of lymphocytes.

The leukocytes and the lymphocytes as well are known to play an important rôle in the so-called defense reactions of the organism, in local as well as general conditions. In inflammation, the first cells to react are the polymorphonuclear leukocytes. They try to neutralize and destroy the foreign, noxious factor. They sometimes phagocytize, but as a rule they disintegrate in the inflamed area and free enzymes or something which is supposed to neutralize the noxious factor. In the general infections they also play an important rôle, which manifests itself in leukocytosis, except in some infections in which the specific toxin has a deleterious action on these leukocytes (typhoid fever). The lymphocytes and monocytes play a rôle in inflammation after the polymorphonuclear leukocytes disappear; I have shown that they are transformed into polyblasts.

The monocytes are also found in many general infections, especially in chronic endocarditis and in some cases of chronic sepsis. The usual number of monocytes in the blood increase, and this is supposed to be a valuable sign of the reaction of the organism which is to destroy the noxious factor.

What is the main symptom of leukemia and agranulocytosis? In leukemia, whether acute or chronic, one must suppose the existence of a specific factor, the nature of which is not known, and this factor stimulates the proliferation of the neutrophilic granulocytes. In the usual case there is a tremendous increase in the number of these granular cells everywhere in the body. A splenic tumor is always present, and the spleen always contains an enormous quantity of myelocytes. As a rule, in leukemia the blood, besides the increase of mature leukocytes, also contains myelocytes. The large quantity of myelocytes in the blood is probably due to the presence of chemotactic substances in the blood which attract out of the tissues not only the mature cells but also the young elements. There are cases, however, in which these chemotactic substances are absent from the blood. Then the number of leukocytes may remain normal, but even in these cases there is usually a large increase in the percentage of young cells. In acute leukemia, many young, immature cells are found.

In the pathogenic form known as agranulocytosis, the condition is different. Probably a toxic factor is acting directly on the granular system and is destroying the cells instead of stimulating them. Owing to the degeneration of the cells which play an important rôle in the defense reaction, the streptococcus or other micro-organisms freely develop and the infection spreads. In leukemia there is the stimulating factor always, with increase in proliferation and production of the granulocytes, but in agranulocytosis there are only signs of degeneration and destruction. In leukemia the monocytes do not play an important rôle, but in agranulocytosis along with the small number of leukocytes in the blood the monocytes are relatively increased. This may be an attempt on the part of the organism to substitute the monocytes for the granulocytes that are destroyed.

Considering the facts presented by Dr. Lewy, I believe that his case was one of agranulocytosis, the only thing against the diagnosis being the presence of myelocytes in the blood. These, however, were found shortly before death and it is well known that the blood picture in the agonal period cannot be relied on for diagnosis. Puncture of the spleen would settle the diagnosis. In leukemia a large number of myelocytes would be found, whereas in agranulocytosis this would hardly be expected.

DR. I. M. TRACE: The patient of Dr. Schoolman had been ill for three weeks with what seemed to be a sore throat with a temperature. A severe hemorrhage had followed an operation on the throat. When the patient was first seen there were large, purpuric spots all over the body. Neither the liver nor spleen could be palpated, and enlarged glands were not found. The left tonsil was represented by a gangrenous, foul smelling, bloody mass. Cultures for Klebs-Loeffler and Vincent's bacilli were negative. Blood examination showed 10 per cent hemoglobin (Sahli); 1,960,000 red cells; 5,100 white cells, with 4 per cent transitionals and 37 per cent myelocytes. The blood platelets were markedly reduced.

For comparison, I will cite the case of a man whom I saw on the same afternoon. Ten days before, the patient became ill with sore throat and a temperature of from 103 to 104 F., and a laryngologist was called. Cultures were negative for the Klebs-Loeffler and Vincent's bacilli. The tonsils were gangrenous and the temperature septic. When he was seen in the hospital, the blood count showed 1,200 white cells, of which only 10 per cent were polymorphonuclears, all the rest being lymphocytes. In spite of several blood transfusions, the man died on the eleventh day of his illness.

Another patient, a woman, aged 42, had been taken ill with sore throat. On the fourth day the physician thought there was a pneumonic process in the lower lobe of the right lung. The white count was 2,000, without any polymorphonuclear cells, and the woman died the same day. She was extremely prostrated and had a low blood pressure, but was mentally clear.

Dr. Schoolman's patient had gangrenous stomatitis, marked anemia, with severe subcutaneous hemorrhages, and leukopenia with 4 per cent transitionals and large numbers of myelocytes. The age of the patient, 10 years, was against the diagnosis of agranulocytosis, not any cases yet having been reported in children. Forty-nine cases are recorded in the literature, and only three patients recovered. Severe hemorrhage rarely occurs in agranulocytic angina, and I believe that the presence of 37 per cent myelocytes in the blood stamped the case as one of acute myeloid leukemia.

DR. MAXIMOW: In normal human blood, granular leukocytes, small cells with a narrow protoplasm, are found. Some are a little older and have a little wider protoplasm with an eccentric nucleus, usually kidney-shaped. In the old days the large cells were called large neutrophils and the others the neutrophilic granular cells and transitionals. Later on the cells were combined and all of them were called monocytes, which I think was much better and less confusing than the old names. There is still a great difference of opinion as to where the monocytes originate, but I believe that the majority come from the hypertrophy of the lymphocytes.

DR. HARRY L. POLLOCK: I saw a patient in Detroit, whose case was one of the few in which a cure of this type had been effected. The man, aged 22, was a patient of Dr. Robb's and had shown the typical picture described by Dr. Lewy. He was treated with blood transfusions and had returned to work when I saw him. The pharynx and mouth were badly scarred. The tonsils, pillars and uvula were gone, but the man apparently was in perfect health several months after his attack, and the blood count was practically normal. At that time, Dr. Robb reported three other cases. One was a recurring condition in a patient who had come from Russia about two weeks before. She developed tonsillitis or angina while on the boat, was very ill and was detained in New York for several days. She recovered, but three months later had a typical attack with a characteristic blood picture. She recovered from this as the result of blood transfusions and about four months later had a third attack. During the interval she was apparently normal, and the blood count was almost normal. On the fourth day of the third attack, she died of what apparently was pulmonary pnuemonia. In this case the pulse rate dropped, and the patient had severe leukopenia. This was the first time my attention had been drawn to a recurrent case.

Dr. Robert Sonnenschein: Would examination of the bone marrow show any difference in the two diseases?

Dr. Maximow: I think it would. In leukemia there should be many myelocytes, while in agranulocytosis one would find monocytes with a low count of myelocytes and especially agranulocytes.

Dr. I. M. Trace: It is an interesting fact that agranulocytosis may occur not only after operations on the tonsils and soft tissues but after injuries to or operations on the bones as well. Dr. Harry Jackson reported a case of a woman with a fractured tibia who developed an agranulocytic angina while in the hospital. Three other cases have been reported in which the condition followed the extraction of teeth and scraping of the alveolar process. It should be borne in mind that agranulocytic angina may occur sometimes following operations on bone, and that it may appear on the mucous membrane or skin.

It is difficult to evaluate the methods of treatment and to understand how transfusion would stimulate the bone marrow which was entirely exhausted. Cases are recorded in which neoarsphenamine has been tried, but in most instances the patients have died. In so severe an infection in which the bone marrow is exhausted and there is cloudy swelling of the liver, the use of neoarsphenamine is adding insult to injury.

Dr. Lewy: Apparently the hemorrhagic diathesis is the principal clinical manifestation in all the leukemias that serves to differentiate them from agranulocytosis. In my case bleeding did not occur until after the tonsils sloughed, which was in favor of the condition being agranulocytosis. I have heard of several other patients with agranulocytosis in Chicago, but the only case that I have seen reported was one that Dr. Harry Jackson presented before the Chicago Medical Society.

My patient was given one dose of sulpharsphenamine and became worse the following day. Thereafter, I took a strong stand against the use of neoarsphenamine.

SECTION ON OTOLOGY AND LARYNGOLOGY OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA

Jan. 18, 1928

James A. Babbitt, M.D., *Chairman*

Measures Which Seem to be Helpful in Preparing a Patient for Operation. Presented by Dr. Samuel M. Wilson.

Dr. Wilson has increased the good effect of hemostatic serum when used to control hemorrhage after tonsillectomy and has guarded against the annoying allergic reactions by combining this substance with epinephrine and obstetric pituitary solution. Two cubic centimeters of serum are drawn into a syringe to which 2 minims (0.12 cc.) of epinephrine and 5 minims (0.3 cc.) of obstetric pituitary solution are added. Five minims (0.3 cc.) are injected subcutaneously, and the patient is directed to lie down. If a reaction does not occur in thirty minutes, the remaining quantity is injected intravenously. In fifteen minutes, the operation may be performed. This method has proved to be of value in patients in whom the coagulation time is unduly prolonged. The same injection is recommended as a preoperative measure in cases in which the thymus causes complication.

If 3.5 grains (0.22 Gm.) of gallic acid and 320 grains (20.8 Gm.) of tannic acid are dissolved by heat in enough water to make 1 fluid ounce, a thin mucilage will be obtained. This solution, applied to raw surfaces after nasal operations apparently assists in healing. Inch strips of gauze moistened with this substance may be packed into the tonsil fossae where it will remain safely for twelve or more hours.

CONGENITAL AURICULAR ANOMALIES, WITH REPORT OF CASES. Presented by DR. J. CLARENCE KEELER.

A search of the records of admissions to the Jefferson Hospital for a period of thirteen years showed that of 16,696 persons, only 13 had come to the hospital on account of auricular anomalies. This rather argues against the frequent opinion and statement that such conditions are common.

Such defects may affect any portion of the ear and are of importance from the standpoint of (1) loss of hearing or (2) cosmetic disfigurement. The most common type of malformation involves the auricle. This deformity often is the cause of various psychic disturbances and repression complexes. Complete absence of one or both auricles, asymmetry of the two ears, absence of a part of the ear, polyotia, macrotia, microtia, otopostasis, drooping ears, false position and synechia are the most common anomalies. According to embryologic study, the greatest number of anomalies of the ear are due to the development of this organ in utero, the most important factors being faulty closure of the two upper branchial clefts, arrest of the unrolling process of the auricle and splitting of the original formation. The external ear is developed from the first ectodermal branchial groove and its adjoining arches. The external acoustic apparatus represents the groove itself, which for a time is in contact with the entoderm of the first pharyngeal pouch. Later, however, this contact is lost, and toward the end of the second month of fetal life the center of the groove deepens, so that it comes to assume a funnel shape, this canal corresponding to the anterior portion of the meatus when fully developed.

From the inner, that is ectodermal, surface, a cellular plate grows back, until it reaches the tympanic cavity. During the course of the seventh month this plate splits, and the space thus added serves to form the inner portion of the external meatus. Much earlier — during the latter part of the second or the early part of the third month — the auricle has begun to assume its definite form. It originally arises from the six elevations which appear, three on the mandibular arch and three on the hyoid arch. Below these elevations on the hyoid, a fold of hyoid integument forms — the auricular fold or hyoid helix. Later a similar fold appears back of the first branchial groove, and this unites with the auricular fold to form the free margin of the auricle. The point of fusion of these two folds, according to Schwalbe, marks the position of the satyr tubercle, while Darwin's tubercle appears at about the middle of the margin of the free auricular fold and corresponds to the apex of the auricle in lower orders of mammals.

The tragus is derived from one mandibular elevation, the helix developing from the other two; the antihelix and the antitragus originate from the elevations on the hyoid. The lobule represents the lower end of the auricular fold. The auricular tubercles may not fuse completely, fistulas thus being left between them. Keith observed such fistulas most often between the tragus and the root of the helix. Such a complicated developmental process could not fail to result in anomalous formation with a fair degree of frequency, and the fact that such a relatively small number of deformities of the ear are recorded in medical literature indicates that it is exceptional for the victims of such malformations to seek relief. My experience does not lead me to believe that the malformed ear is any more likely to become diseased than the normal one, and it would seem that unless disease intervenes, the average person bears his misfortune as best he may, and seldom entertains the idea of abolishing or ameliorating it.

A roentgen-ray examination is always essential in order to determine the condition of the deeper structures of an ear in which the auditory meatus is concealed. In many cases such an examination, especially in children, yields exact results. Functional tests and vestibular examinations are of value in determining the condition of the auditory apparatus, thus indicating the result that may be expected from operative interference.

The choice of operation depends on the particular case, and definite rules cannot be followed for dealing with these defects. The application of prin-

ciples of plastic surgery developed during the World War enables one to attain far more satisfactory results than were formerly considered possible.

The thirteen cases previously mentioned were then presented by Dr. Keeler. From his experience with this type of case, he concludes that malformations of this type have their origin during early fetal life, the cause of which is a mystery and beyond control. The possibility of correction has, in many cases, been demonstrated, and every possible consideration should be given to methods of reconstruction so that defects both cosmetic and functional may be lessened or abolished.

SURGICAL CORRECTION OF AURICULAR ANOMALIES. Presented by DR. ROBERT H. IVY.

Dr. Ivy said that the surgical correction of deformities and defects of the external ear is discouraging. In this field, the results obtained are far behind those of nasal and facial surgery. This is easily understood when one considers that the structure of the ear is a thin plate of cartilage covered by two layers of skin. In cases in which there is congenital absence of the external ear associated with absence of the external canal, although the internal structures may be intact, construction of an auditory canal is not a feasible procedure. It is not wise to attempt the construction of an absent auricle in infancy. The congenitally projecting ear can easily be brought into a neutral position by any one of a number of operations. Frequently it is necessary to utilize skin from the regions adjacent to the ear for the reconstruction of the auricle. Such procedures are only moderately satisfactory. Many times it is better to use an artificial ear reproduced in vulcanite or cast in silver, painted a suitable shade and fixed to the skin with actor's cement.

DISCUSSION

DR. ALEXANDER RANDALL: I am pessimistic concerning the results of plastic aural operations. I shall show a number of slides which demonstrate the various possible anomalies of the ear.

LATENT INFECTION OF SINUSES WITH SYMPTOMS OF DISEASE OF THE LOWER PART OF THE RESPIRATORY TRACT. Presented by DR. LOUIS H. CLERF.

Dr. Clerf has found that sinus disease is extremely common in suppuration of the lung. He divides cases of bronchiectasis into two groups: (1) those associated with sinus disease and (2) those in which sinus disease cannot be demonstrated. In the first group, there is frequently a history of cough dating back to infections of childhood, and examination of the chest shows bilateral changes varying from a suppurative bronchitis to extensive bronchiectasis. Although there is often no history or symptoms of nasal infection, careful study practically always shows evidence of pathologic changes in the sinus. In the second group, the lesion in the lung was commonly unilateral and usually limited to a single lobe. In this type of case infection of the sinus was practically never observed. Treatment in these cases is unsatisfactory when the disease has been of long standing. In recent cases, results can be obtained. Dr. Clerf is convinced that examination of a patient complaining of chronic cough is never complete until a careful study of the nasal sinuses has been made; a negative opinion on sinus disease should not be given until every diagnostic means has been used.

LATENT INFECTION OF SINUSES WITH SYMPTOMS OF DISEASE OF THE LOWER PART OF THE RESPIRATORY TRACT. Presented by DR. AUSTIN T. SMITH (by invitation).

In 1914, Sir St Clair Thompson first called attention to the frequency of sinus suppuration associated with chronic bronchitis. In 1916, the French army

officers, Rist, Sergeant and Saylor made the first comprehensive clinical contribution concerning this condition. It was demonstrated in 1921 that infection can be transmitted to the lung from the sinuses by: (1) inhalation or (2) lymphatic absorption by way of the submaxillary and deep cervical nodes into ducts and veins to the right side of the heart and then to the lung.

Association with many of these cases at the bronchoscopic clinic has led to the following conclusions.

1. The importance of the relationship between latent sinus infection and disease of the lower part of respiratory tract is not generally appreciated by laryngologists or internists.

2. The coexistence of sinus disease and infection of the lower part of the respiratory tract is not coincidental.

3. Every patient with symptoms of bronchopulmonary infection in which the condition is not acute should be considered potentially as having sinus disease.

4. A negative report concerning the presence of sinus infection in cases of bronchopulmonary disease should be given only after every means of diagnosis at one's command has been utilized and only after repeated study and observation over a period of time.

5. The difficulties of eliminating sinus disease as a diagnostic possibility are not generally appreciated.

DISCUSSION

Dr. Nathan P. Stauffer: How are children with sinus disease treated; also how is iodized oil 40 per cent removed from the lung.

Dr. George Fetterolf: I was greatly impressed by this paper. In my experience the point has not been reached when the diagnosis of sinus disease is an exact science even when all possible means of diagnosis are used. I use the nasopharyngoscope as a routine measure. A negative diagnosis should not be given on one examination only, as conditions may vary from day to day. Years ago, winter bronchitis was often mentioned. This condition usually disappeared after the patient spent some years in a warm climate. The probably was nothing more than pathologic changes in the sinus associated with bronchitis, as we all know that many patients with sinus infections improve better in the South. Treatment in these cases is unsatisfactory. I should like to have Dr. Smith give an exact interpretation of the term conservative sinus treatment.

Dr. Smith: Treatment in children consists of shrinkage of the nasal mucosa, negative pressure and colloidal silver. It is extremely important that the general nutrition of the child be given careful attention; therefore a concentrated, fat soluble, vitamin diet is prescribed.

Dr. Clerf: Treatment of the sinuses apparently is of benefit in some of these cases. The materials used in outlining the lungs are harmless. Bismuth subcarbonate disappears in forty-eight hours. Iodized oil 40 per cent remains longer, and may be present for weeks. In children, a dosage of from 6 to 10 cc. is used, while in adults 40 cc. may be used without danger.

Book Reviews

FUNCTIONS OF THE INTERNAL EAR. DR. P. J. MINK. The Hague: Martinus Nijhoff, 1927.

The author admits that the most universally accepted theory of hearing is that of Helmholtz. Other authors have advanced ideas of audition, some based on and others in contradiction to the Helmholz theory, but Dr. Mink can rank them only as hypotheses. Most of those hypotheses were advanced as preconceived ideas — that is, arguments were found to substantiate conclusions previously accepted. The author apparently is not satisfied with the theory of Helmholtz or the other theories of audition. As an introduction, he states that he is not to be embarrassed by a preconceived idea, and in his investigation of audition he is accepting the anatomic and physical conditions as he finds them.

The anatomy and physics of the middle ear is briefly discussed, and the impulse that is transmitted by the footplate of the stapes is accepted as a guide in the investigation of the labyrinth. This impulse he terms mobility or pressure.

For the application of physical laws in dealing with the cochlea, the perilymphatic and endolymphatic systems are regarded as acting differently under the same impulse. The perilymphatic system is found to be a completely closed vesicle, with only two portions of its wall yielding to pressure — the round and the oval window. The aqueduct of the cochlea is here purposely disregarded, as the anatomic preparations show that it serves only in the capacity of a filtrating space, in maintaining communication with the cranial cavity, and in considering impulses of such brief duration as are found in sound, can be excluded entirely. Thus, while the footplate of the stapes imparts the impulse to the perilymph, the round window limits and governs the mobility of the fluid. Applying the law of Pascal, then, the movements of the perilymph should be as that of a column and not as a current. The pressure of the footplate of the stapes is transmitted immediately and without loss to all parts of the labyrinthine perilymph, but on account of the yielding of the round window and the endolymphatic system the movement is limited to the cochlea.

The endolymph, unlike the perilymph, enjoys an escape from the labyrinth through the aqueduct of the vestibule to the endolymphatic sac. The delicate capsule of the endolymph can offer only minimum resistance to any pressure exerted by the perilymph. Consequently, any movement of the perilymph which acts as a solid column affects the entire surface of cochlear endolymphatic membrane immediately and with uniform force. As the labyrinthine equilibrium in the state of repose is maintained and governed by intracranial pressure, the endolymph of the cochlea is forced toward the endolymphatic sac when this equilibrium is disturbed by the pressure of the footplate of the stapes. Equilibrium is reestablished by oscillations between the sac and the saccule; so the movements of fluid in the endolymphatic system is that of a current and consumes time.

As the endolymph is forced toward the sac, the walls of scala media are forced inward. Reissner's membrane, because of its uniform structure and osseous attachment at either end, bends uniformly with the summit of the curve at its middle. The basilar membrane acts more like a sail of a boat held by a long rope before the wind, the zona arcuata bending the more because of its elastic fiber framework and held by the zona striata, which yields considerably because of its external attachment to the spiral ligament. This forcing inward of the basilar membrane causes an elevation of the organ of Corti, affecting a contact of the hair cells with the membrane of Corti. Dr. Mink is of the opinion that the hair cells extend freely into the space

between the membrane and the organ of Corti. He believes, however, that this contact is affected gradually and by segments along the spiral papilla. He found a segmentation along the spiral papilla, the number of fibers of the basilar membrane, the cells which they support and the dents of Huschka corresponding in multiples. As the basilar membrane yields more readily at the apex of the spiral on account of the length of its fiber, the organ of Corti reaches the limit of its physiologic capacity at its vestibular end. On account of the current-like movement of the endolymph and the greater resistance of the basilar membrane as its fibers decrease in length toward the vestibular end, the contact of the hair cells is affected gradually, but depends on the force of the perilymphatic pressure. He found that this contact can be affected by other means than by sound, and also that it does not explain the mechanics of hearing when sound reaches the internal ear by other routes than that of the footplate. He questions Witmack's experiment on the effects of sustained sound on the organ of Corti. Dr. Mink subjected animals to sound, the force of which exceeded physiologic limits, and he found that destruction was confined to the cochlea.

As he found only contact in the cochlea and that dependent on the force of the pressure of the footplate of the stapes, he is not satisfied to accept it as completely explaining audition, especially since audition is not completely abolished in stapes fixation.

In turning attention to the vestibule and semicircular canals, the author found that he cannot depend on the mobility of the fluids as a guide, because only the maculae of the saccule would be affected, and here he would again find only contact of the hair cells with their overlying structure — a condition that did not entirely satisfy him in his investigation of the cochlea. Realizing that sound enters the internal ear through all its walls, he turned his attention to the molecular movement of sound as a guide. In the semicircular canals he saw an arrangement that immediately suggested sound interference, namely, the three planes of the canals which are mutually perpendicular. In order to study the effects of molecular movements of sound on a structure such as the vestibule and the canals, he devised an apparatus mechanically resembling this portion of the internal ear. As the author is interested only in the search for audition, he dismisses consideration of the universally accepted theory of the function of this part of the structure.

The apparatus devised to study the molecular movements of sound consisted of a cubic box of oak. In one corner an opening was made directed in a diagonal manner toward the opposite corner, where a similar opening was made as a means of exit. Then other openings were also made in the three sides of the box mutually perpendicular to each. All these openings were insulated and connected with tubes to cassettes in which were placed delicate aluminum diaphragms. Each of the cassetes in relation to the mutually perpendicular planes was connected by tubes to another to simulate the semicircular canals. Every means was employed to exclude extraneous sound. Sound was introduced through one of the openings in the corner of the box and results noted at the four openings of exit. In the straight line across the box to the opposite corner he found the quality and timber of the sound unaltered, but from the openings in the mutually perpendicular planes the timber of the sound was decidedly altered or as he specifies detimbered. He employed a trained singer in an effort to determine the amount of detimbering, but could not arrive at a definite conclusion as to the amount that took place. He was unsuccessful in constructing instruments to perfect this study.

Applying the mechanics of the experimental apparatus to the vestibule and canals, he found the maculae of the saccule and uticule in a position and of a structure to accept unaltered sound and without interference. The sound which enters the semicircular canals suffers from interference because of their mutually perpendicular planes, and in consequence the sound is detimbered. He moreover contends that sound should be better perceived by the maculae

and cristae because their overlying structures are in constant contact with the hair cells, a factor which should aid in the perception of the molecular movements of sound.

In a speculative manner the author discusses the auditory concept in consciousness, but it adds little to his conclusions. He wishes to present his conclusions, not as a theory but as a new idea, that audition is affected primarily in the maculae of the saccule and the utricle, that the semicular canals determine the timber, and that volume is controlled by the cochlea.

Directory of Ophthalmological and Otolaryngological Societies

INTERNATIONAL

FIRST INTERNATIONAL OTO-RHINO-LARYNGOLOGICAL CONGRESS

President: Prof. E. Schmieglow, University of Copenhagen.
Place: Copenhagen, Denmark. Time: July 29-Aug. 1, 1928.

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman: Frank R. Spencer, 1345 Spruce St., Boulder, Colo.
Secretary: William V. Mullin, Cleveland Clinic, Cleveland.
Place: Minneapolis. Time: June 11-15, 1928.

AMERICAN BRONCHOSCOPIC SOCIETY

President: Dr. Sidney Yankauer, 780 Park Ave., New York.
Secretary-Treasurer: Dr. Louis H. Clerf, 128 S. 10th St., Philadelphia.

AMERICAN LARYNGOLOGICAL ASSOCIATION

President: Dr. Bryson Delavan, 40 E. 41st St., New York.
Secretary: Dr. George M. Coates, 1721 Pine St., Philadelphia.
Place: Hotel Raleigh, Washington, D. C. Time: May 1-3, 1928.

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY

President: Dr. John F. Barnhill, 241 N. Pennsylvania St., Indianapolis.
Secretary: Dr. R. L. Loughran, 33 E. 63d St., New York.
Place: Raleigh Hotel, Washington, D. C. Time: May 3-5, 1928.

AMERICAN OTOLOGICAL SOCIETY

President: Dr. Max A. Goldstein, 3858 Westminster Pl., St. Louis.
Secretary: Dr. Thomas J. Harris, 104 E. 40th St., New York.
Place: Raleigh Hotel, Washington, D. C. Time: April 30-May 1, 1928.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. Luther C. Peter, Physicians Bldg., Philadelphia.
Secretary: Dr. William P. Wherry, Medical Arts Bldg., Omaha.
Place: Hotel Statler, St. Louis. Time: Oct. 15-19, 1928.

LOCAL

THE COLORADO OTO-LARYNGOLOGICAL SOCIETY

President: Dr. C. Howard Darrow, Metropolitan Bldg., Denver.
Secretary: Dr. Harold L. Hickey, Imperial Bldg., Denver.
Place: Assembly Room of Metropolitan Bldg. Time: First Saturday of each month from October to May.

SECTION ON OPHTHALMOLOGY AND OTO-LARYNGOLOGY OF THE MEDICAL SOCIETY OF THE DISTRICT OF COLUMBIA

Chairman: Dr. Walter A. Wells, The Rochambeau, Washington, D. C.
Secretary: Dr. J. N. Greear, Jr., 1740 M St., Washington, D. C.
Place: 1718 M St., N. W. Time: 8 p. m., third Friday of each month.

ATLANTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Arthur J. Fort, Medical Arts Bldg., Atlanta, Ga.
Secretary: Dr. Leon E. Brawner, 157 Forrest Ave. N. E., Atlanta, Ga.
Place: Academy of Medicine, 38 Prescott St. N. E. Time: 8 p. m., last Thursday of each month.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

President: Dr. Arthur M. Corwin, 25 E. Washington St., Chicago.
Secretary: Dr. Austin A. Hayden, 25 E. Washington St., Chicago.
Place: Grill Room, Stevens Restaurant, 16 N. Wabash Ave. Time: 6 p. m., first Monday of each month from October to May.

INDIANAPOLIS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

President: Dr. Thomas Hood, Hume-Mansur Bldg., Indianapolis.
Secretary: Dr. Kenneth L. Craft, Hume-Mansur Bldg., Indianapolis.
Place: University Club. Time: 6:30 p. m., second Thursday of each month from October to May.

NEW ORLEANS OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY

President: Dr. Val H. Fuchs, Chaille Medical Bldg., New Orleans.
Secretary-Treasurer: Dr. Carl E. Granberry, Maison Blanche Bldg., New Orleans.
Place: Senses Hospital, Touro Infirmary, and Charity Hospital (in rotation).
Time: 8 p. m., third Thursday of each month from September to June.

SECTION ON OTOLOGY AND LARYNGOLOGY OF THE BALTIMORE CITY MEDICAL SOCIETY

Chairman: Dr. Edwin N. Broyles, 1100 N. Charles St., Baltimore.
Secretary: Dr. Waitman F. Zinn, Medical Arts Bldg., Baltimore.
Place: 1211 Cathedral St. Time: 8:30 p. m., last Friday of each month.

DETROIT OTO-LARYNGOLOGICAL SOCIETY

President: Dr. Ray Connor, Stroh Bldg., Detroit.
Secretary-Treasurer: Dr. William Fowler, Maccabees Bldg., Detroit.
Place: Maccabees Bldg.. Time: Third Wednesday evening of each month from October to May.

THE KANSAS CITY EYE, EAR, NOSE AND THROAT SOCIETY

President: Dr. A. J. Lorie, 409 Commerce Bldg., Kansas City, Mo.
Secretary: Dr. A. E. Eubank, 636 Argyle Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May; the November, January and March meetings are devoted to clinical work.

NEW ENGLAND OTOLOGICAL AND LARYNGOLOGICAL SOCIETY

President: Dr. Gordon Berry, 19 Elm St., Worcester, Mass.
Secretary and Treasurer: Dr. Calvin B. Faunce, 320 Commonwealth Ave., Boston.

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Place: 91 Lincoln Park, South. Time: 8:45 p. m., second Monday of each month.

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Secretary-Treasurer: Dr. Walter F. Hoffman, 817 Summit Ave., Seattle.
Place: Santa Barbara, Calif. Time: April 18-20, 1928.

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Secretary: Dr. M. B. Selingstein, 801 Union and Planters Bank Bldg., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

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Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., first Thursday of the month from September to June.

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Place: University Club. Time: 6 p. m., first Friday of each month except August.

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CONTENTS

PAGE

Reconstructive Surgery. J. Eastman Sheehan, M.D., New York 299

Hyperesthetic Rhinitis. L. Benno Bernheimer, M.D., Chicago 312

A New Aid in the Diagnosis of Mastoiditis. Isidore Friesner, M.D., and Samuel Rosen, M.D., New York 317

Otosclerosis: A Review of the Literature. R. R. Montgomery, M.B., Long Beach, Calif 321

The Use of Iodized Oil in the Diagnosis of Nasal Sinus Disease: Part I. Hilding Anderson, M.D., with the Technical Assistance of Mrs. Clara MacDougal, Duluth, Minn 340

The Sensory Field of the Facial Nerve. Simon L. Ruskin, M.D., New York 351

Clinical Notes:

The Phenomenon of Subjective Sound Perception for Words and Sentences; Report of a Case. Robert G. Reaves, M.D., Knoxville, Tenn 359

Gradenigo's Syndrome: An Interesting Case. S. B. Forbes, M.D., Tampa, Fla 363

Progress in Otolaryngology. A Summary of the Bibliographic Material Available in the Field of Otolaryngology. Tonsils and Adenoids. French K. Hansel, M.D., St. Louis 365

Miscellany:

Professor Siebenmann's Seventy-Fifth Birthday. J. Holinger, M.D., Chicago 381

News and Comment 386

Abstracts from Current Literature 387

Society Transactions:

Chicago Laryngological and Otological Society 395

Section on Otology and Laryngology of the College of Physicians of Philadelphia 404

Book Reviews 408

Directory of Ophthalmological and Otolaryngological Societies 411